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The Institute of Vitreous Enamellers

The Welsh Engineers' and Founders' Association

The Foundry Trades' Equipment and Supplies Association

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Foundry Technical Institute, Meek's Road Falkirk (*Phone:* 332)

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National Ironfounding Employers' Federation.
British Ironfounders' Association.
National Association of Malleable Ironfounders.
Ironfounders' National Confederation.
British Bath Manufacturers' Association.
British Malleable Tube Fittings Association.
Cast Iron Chair Association.
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Cast Iron Segment Association.
National Ingot Mould Association.
Cast Iron Axlebox Association.
Institute of British Foundrymen (affiliated).
British Cast Iron Research Association (affiliated).
British Grit Association (affiliated).
Agricultural Engineers' Association (affiliated).

One More Committee?

It appears to us that for the better prosecution of the war, there is need for the creation of still one more committee. This, superficially, does not have the appearance of adding to our popularity, but there is a serious gap in the organisation of the steel foundry industry, which requires filling. Through lack of foresight on the part of past Governments, the not inconsiderable steel foundry industry of the last war was allowed to shrink during the slump to dangerously small proportions. Just before and during this war there has been a very considerable expansion; moreover, old-established firms are being required to tackle new types of jobs, and some make an immediate success of them, whilst others require more time than can be spared at the present for getting into production. The weights of some castings vary in order to take care of machining allowances by more than 25 per cent. This, *inter alia*, causes much coming and going between foundries inspecting each other's methods. A comparison with the iron foundry organisation reveals exactly where the steel foundry industry is weak. In ironfoundry, research work is carried on by the B.C.I.R.A., which additionally and probably preferentially is undertaking much development work. That is, it makes itself familiar with new jobs, and where difficulties in production arise, it sends its officers to the actual foundries to get things going. Then the Directors of Iron Castings have their own technical advisory committee, and so has the Council of Iron Foundry Associations. Moreover, a committee of the Institute of British Foundrymen has been energetically employed in creating, what eventually turned out to be a group of steel foundries!

The steel foundry is well served for pure research work, through the joint auspices of the British Iron and Steel Federation and the Iron and Steel Institute, supported by the General Steel Castings Association—but there is no development and advisory work in progress such as there is with iron castings, and this is the very committee we suggest should be formed. Moreover, the committee we visualise would not be merely a periodic assembly of half-a-dozen or so of the better known foundry managers, but the reinforcement of such a body by a high grade competent official supported by a staff. The work of this permanent and perhaps somewhat curious committee would include questions of standardisation, of design, and of methods of moulding, composition of metal, fuel economy, and technical help in achieving the production of high grade castings. It would advise the Director of Steel Castings and co-operate with the fighting services in the simplification of design. We leave the obvious utility of such an organisation for post-war development to the imagination of the leaders of the steel foundry industry. The American counterpart of the General Steel Castings Association has provided all the necessary pointers. It is obvious, that by the creation of such an organisation as we have outlined, that the industry will gain in status, for it must be borne in mind that employers' associations (except those negotiating with the trade unions) exist for three purposes only. One is to ensure an economic return for their efforts; the second to provide a voice to speak for the industry in matters concerning Governmental orders and other influential bodies, and the third, which we rate as of equal importance, the giving of service to its customers. At the moment, the all-important customer is the Government through its various departments, and we have every reason to believe that the step we propose will be enthusiastically received by the clientele. We sincerely hope that our proposals will be equally well received in steel castings circles.

Book Review

New Methods for Sheet Metal Work, by W. Cookson. Published by The Technical Press, Limited, "Piccancot," Gloucester Road, Kingston Hill, Surrey. Price 7s. 6d.

The reviewer often wonders whether or not an engineer's patternmaker could derive advantage from a study of the methods used by sheet metal workers in setting out their jobs. The main difference, of course, is that metallic sheets can be bent, and wood cannot, yet when one examines the patternmaking for a propeller, consisting, as it does, mainly of sweeps, one sees that there can be a connection. This book appeals to the reviewer as being much more practical than the average treatise on the subject; the illustrations, which are so very important in this type of book, are particularly clear. Added interest is given by the fact that entirely new methods are disclosed.

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Old Metal and New

By "Onlooker."

The force of circumstances is compelling this country in this third year of war to face the fact that we must in every possible way become more and more self-supporting in regard to all essential materials. Obviously an island maintaining a population of some 45,000,000 people cannot produce all its own food, nor can a highly industrialised community working at high pressure on the production of munitions, a considerable proportion of which is destined for Allies overseas, hope to find at hand all the raw material required for this output. What can be done in the direction of making ourselves independent of outside aid must however be undertaken under the stress of war with vigour and determination, for we have been told, not once but many times, that shipping is increasingly needed for other vital purposes, some of which can only be guessed at. Japan has seized much of the world's tin producing capacity, and therefore Cornwall's tin mines must be given every assistance to bring more and more metal to the surface so as to eke out what can be secured from Nigeria, Bolivia and elsewhere. Every ton of iron that can be spared from railings, old lines, etc. (and most of what cannot) must be yielded up in order that tank production can go forward on an ever increasing scale, while the drive for wastepaper and the like ought to be prosecuted with even greater vigour.

It will be remembered that there was a call for household aluminium utensils when the position in that metal gave cause for anxiety, and as a result some hundreds of tons were secured, all of which doubtless served a useful purpose in the war effort. Long ago in Italy and Germany the housewife was called upon to yield up copper and brass utensils, but so far in this country we have not gone beyond parting with the garden railings perhaps, and any old metallic junk lying about the place, which is better out of the way in any case. There must, of course, be a rare lot of domestic brass and copper up and down our land, for the aggregate tonnage of curtain rail alone is doubtless considerable. Hearth furniture, lamps, stair treads, door knobs—there is no end to the list if one sets out to compile it—and if every building were stripped of all its copper and brass there would be many gaps, possibly more than most people imagine, for in spite of rival substances, such as plastics, copper and its alloys still mean a lot in our daily lives. Fortunately, there does not appear to be any likelihood of drastic measures developing, but obviously every citizen will consider what surplus metal he can spare and offer it to the authorities.

In non-ferrous metals, however, the most important contribution comes from the dismantling of plant which is worn out or obsolete, the breaking up of machinery and the withdrawal from service of installations—electrical and otherwise—which are either no longer required or stand in need of replacement. After the heavy air raids on this country large quantities of metal, particularly lead, were recovered from damaged and demolished buildings, but this has probably all been pretty well cleared up now. There is, however, always a steady flow back to the manufacturing system of the discards of our daily life, and one has only to study the details of condemned stores offered for sale by tender by the G.P.O. to realise how these items mount up. In normal times the shipbreaking yards yield a lot of stuff, but that is not happening to-day; there are, however, many other directions in which, with the old giving place to the new, raw material for the copper refineries and brass foundries becomes available in surprisingly large quantities. Most of this material has to be treated and broken up into its several constituent parts, but there are firms in this country who are specialists in this work, and no hold up is likely to occur there.

Notes from the Branches

London.—The organisation for the holding of a Brains Trust evening—devoted to purely metallurgical and foundry questions—is now complete. The event is to take place at the National Liberal Club at 7.15 on April 30. Mr. R. B. Templeton, the Branch-President, is to act as question master, the guest experts are to be Dr. C. H. Desch, F.R.S., and Mr. E. Longden, of Manchester. London members, Dr. A. B. Everest, Mr. A. J. Murphy, M.Sc., Mr. A. E. McRae Smith and Mr. C. H. Kain will complete the panel. It will be seen that most sections of the industry are represented, and the members, president and council of the London Branch would appreciate questions from all over the country. These should be sent on postcards to the honorary secretary, Mr. V. C. Faulkner, 3, Amersham Road, High Wycombe, Bucks.

East Midlands.—The annual meeting of the Branch was held at Loughborough College on March 21. Mr. H. J. Beck presided, and the following Branch officers were elected for the 1942-43 session:—

Branch-President: Mr. H. G. Harback.
Senior Vice-President: Mr. W. H. Smith.
Junior Vice-President: Mr. F. G. Butters.
Hon. Secretary: Mr. S. A. Horton.
Branch Auditors: Mr. A. B. Bill and Mr. R. H. Buckland.
Representatives on General Council: Mr. A. E. Peace and Mr. W. H. Smith.
Elected Branch Representative on General Council: Mr. H. Bunting.

The following members were elected to the Branch Council, the first three to serve for three years, and the fourth two years:—Mr. J. F. Measures, Mr. F. Dunleavy, Mr. J. K. Jackson and Mr. H. R. Dunton.

The Secretary (Mr. S. A. Horton) reviewed the Branch activities during the past session. Seven meetings had been held, and the subjects discussed covered a wide range—sand control, patternmaking, running and feeding of ferrous and non-ferrous metals, and heat-treatment furnaces.

The attendance of the members has endorsed the Council's selection of Papers, the average being 52. The membership continues to increase and 1941 was a record year, both for the amount of subscriptions received and membership. Unfortunately, during wartime conditions, it has not been possible to hold a Branch meeting in Leicester. The Leicester members were sincerely thanked for their continued loyal support.

The annual dinner, held on March 19, was very successful, 62 members and guests participating. The Branch was honoured by the company of several distinguished guests. The meeting closed with a hearty vote of thanks to the President and Branch Council for their work during the session. A Short Paper Competition was then held, the entries for which will appear in our columns in the near future.

Bessemer Converter Capacity in the United States

In the United States, the Bessemer process was dominant from 1870 to 1910; but from then on it has fallen far behind open-hearth steel output, states J. S. Fulton in "Compressed Air Magazine." In 1910 it contributed 9,000,000 tons of the total United States production of 26,000,000 tons, but in 1937 it accounted for only 3,500,000 tons of the 50,000,000-ton output. Under the impulse of the national defence programme, steel companies are now putting idle converters back into service. The present annual rated capacity of all converters in the U.S.A. is 7,000,000 tons; by rehabilitating plant not now in use, the potential capacity can be raised to 9,600,000 tons. Accordingly, there is a considerable reserve that can be utilised merely by increasing the supply of pig-iron. This is especially important at this time when open-hearth facilities are running at 100 per cent. of their rated capacity, while electric furnaces have reached 103 per cent.

Random Shots

How many metallurgists to-day could remember one single detail of the first lecture they attended on the subject? Would anybody, who had been exercising his faculties for a number of years over the problems of modern developments and trends in the sphere of metals, remember, for instance, that almost the first development of which they learned in those far-off student days was that of the Osmund furnace? It was like an echo from a long-forgotten past to read in that most fascinating journal "Hakluyt's Voyages," of the complaints against Hans merchants who, "in the yeere of our Lord 1396, tooke upon the maine sea betweene Norway and Scaw, one crayer laden with osmunds, and with divers other marchandises, perteining unto John Brandon on Lenne, to the summe and value of 443 lib. 4s. 2d. Moreover, they tooke from John Lakingay 4 lasts and an halfe of osmunds, to the value of 220 lib. 10s." It is interesting to note that in those days the products of the Osmund furnace were commonly known as osmunds, just as to-day one talks of Bessemer; whether it be the metal, the man, the furnace or the process that is referred to generally being understood by the context.

* * *

Incidentally, further perusal of the voyages in question gives some very pertinent observations on other matters of special and universal interest at the present time. Of the "discipline of warre among the Russes" in the middle of the 16th century, it says: "I beleeve they bee such men for hard living as are not under the sun; for no cold wil hurt them. Yea and though they lie in the field two moneths, at such time as it shall freese more then a yarde thicke, the common souldier hath neither tent nor anything else over his head; the most defence they have against the wether is a felte, which is set against the winde and weather, and when Snow commeth hee doth cast it off, and maketh him a fire, and laieth him down thereby. Their lying in the fielde is not so strange as is their hardnes; for every man must carie and make provision for himselfe and his horse for a moneth or two, which is very wonderful. For he himselfe shal live upon water and otemeale mingled together cold, and drink water thereto. . . . I pray you amongst all our boasting warriors how many should we find to endure the field with them but one moneth? I know no such region about us that beareth that name for man and beast. Now what might be made of these men if they were trained and broken to order and knowledge of civill wars?"

* * *

Another chronicler of a century earlier records in the same book this view of "the Englishe policie":

"The Irishmen have cause like to ours,
Our land and hers together to defend,
That no enemie should hurt ne offend,
Ireland ne us; but as one commontie
Should helpe well to keepe about the sea.
For they have havens great, and goodly bayes.
Sure, wyde, and deepe, of good assayes,
At Waterford, and costes many one.
And as men sayne in England, be there none
Better havens, ships in to ride,
No more sure for enemies to abide."

* * *

When you pay your income-tax, consider this: How much do you think France would pay to-day for another chance?—Paraphrased from the "Houghton Line."

"Marksman."

The "Speedy" Moisture Tester

In Robson Refractories, Limited, recent advertisement in the Foundry Trade Journal, it was inadvertently stated that in the "Speedy" moisture tester described sands can be tested to 1 per cent. in 2 min. This should, of course, read 0.1 per cent. in 2 min.

Foundry Production Problems with Special Reference to High Duty-Alloy Cast Iron

By A. E. McRAE SMITH

(*Continued from page* 228.)

Runners and Feeding

When tackling the production of any particular design of casting in high strength cast iron, before the pattern or moulding tackle is made for the job, the foundryman should invariably give ample consideration to the attainment of complete solidity and soundness in the finished article. All possible means should be taken as far as distribution, type and shape of runners are concerned to ensure progressive solidification. In general this is usually accomplished by making certain that the following conditions are fulfilled as far as possible:—

(1) The difference in rate of cooling between thin and thick sections should be equalised as much as possible. This is usually achieved by superheating the portions of the mould which form the thin sections and so directing the flow of metal that colder metal fills the heavier sections.

(2) Other conditions, such as importance or location of machined faces permitting, arrangements should be made to cast the heavier masses towards the top and, by a combination of design of runners and use of feeding heads, ensure progressive solidification from the bottom upwards.

(3) Where external feeders cannot be used equalisation of cooling should be attempted by the very careful use of external denseners placed either in the core or mould body.

(4) Rod or puddle feeding must on no account be attempted in the production of castings, where complete uniformity of properties is required throughout the mass.

In this connection, of course, the term "uniformity" is used in a comparative sense since there will be some difference in properties between thin sections and heavy sections. It should be remembered, however, that with the compositions and special processes now available for the production of high strength cast iron, this gradient or decrease in tensile strength as the sectional thickness increases and consequently the cooling time is prolonged, is very much less than is the case in the weaker, higher carbon, non-alloy cast irons.

In order to illustrate this a few typical simple examples are given. It must be borne in mind that these are of a very elementary nature, and appertain to simple shapes of castings. The same principles, however, can be applied to the largest casting and the most complicated casting. Dealing with particular portions of the castings on the lines indicated, *i.e.*, in the case of heavy marine engine cylinders, Diesel engine castings, air compressor castings, hydraulic castings and even machine tool castings, it is often advisable to use a combination of the principles indicated. It is well known, of course, to most foundrymen that simple, lumpy castings, if they have to be completely sound throughout their whole mass, are very often more difficult to produce than large castings like bedplates, etc., weighing many tons. The larger the casting, other things being equal, the slower the rate of cooling, and consequently there is less tendency for sharp differences in cooling rates in a big casting, even provided it shows considerable diversity of sectional thickness. Usually heavy masses in large castings, even when adjoining comparatively light sections, can be dealt with individually.

Self-Feeding Heads

Examples of self-feeding heads will be dealt with first, and Fig. 4 shows a typical plain liner casting. These castings are of the simplest possible design, and are in fact small plain sleeves, and of course are found in foundry practice in all sizes from very small thin-walled castings up to very heavy plain hydraulic liners, etc. The illustration and all those to follow naturally apply only to sand castings. Similar castings are made very extensively and in very large numbers by centrifugal casting methods in spun metal moulds. The essentials of this latter method, namely rapid cooling coupled with centrifugal force, eliminate the possibility of all liquid shrinkage defects.

Fig. 4 shows at D a method which is often erroneously employed. Even in comparatively

Fig. 20.—Casting of a CO_2-Pump Body, showing Large Feeding Head.

thin walled liners a feeding head composed merely of an extension of the casting is rarely satisfactory, unless, of course, it is of excessive height. Such a casting irrespective of the method of pouring tends to solidify in the form of a shell, and consequently the last portion to solidify may be at some point lower than the top of the casting proper. To avoid this it is common practice to adopt either of the other three designs of feeding head A, B and C. Each of these has in common the characteristic of possessing a greater bulk of metal, which will remain liquid and feed the casting after the casting proper has solidified. Personally, type C is preferred because it is easy to mould, easy to handle, and has advantages for manipulating the casting in the machine shop. Type A is equally good, but where castings have to be chucked from the head end this completely tapered form presents disadvantages. Type B is rarely employed unless it is desirable or necessary to economise in the size of box required to produce the casting, or some such consideration.

In all cases plain liners of this type should be entirely top run, usually with jet runners round the top of the feeding head. This makes doubly sure that the feeding head is the last portion to solidify, and promotes progressive solidification from the bottom upwards. Even in very simple castings of this kind it is bad practice to run them from the bottom, because this upsets progressive solidification, superheating the bottom of the mould and tending towards promoting initial solidification somewhere towards the middle of the casting.

Progressive Solidification

Fig. 5 shows a similar type of liner casting carrying a top flange. This illustration is self-explanatory, but it should be noted that with all liners of this type the thickness section of metal and therefore the portion likely to be the last to solidify is on the diagonal between the top inside of the bore and the bottom outside of the flange as indicated at X. The section of the feeding head at its base should be at least greater than the dimension X.

Fig. 6 represents diagrammatically a type of casting which is sometimes encountered in the form of gland sleeves, liner castings, elongated bushes, etc., where a heavy flange is situated remote from either end of the casting. In this case, in order to promote uniform density of structure and progressive solidification, it is usual practice to use comparatively heavy external denseners. In some cases it is possible, where the heavy flange is near one end of the casting to add an extra machining allowance and adopt the normal type of flared feeding head. This, of course, is to be preferred where it can be used since denseners may then be dispensed with.

These first three simple illustrations of liners and sleeves show methods which, of course, may also be adapted to similar portions of large and complicated castings, for example locomotive cylinders, gas compressor bodies, etc.

Forging Die Sleeves

Fig. 7 shows a typical forging die sleeve as used in the manufacture of pot-like forgings from square steel billets. Usually the wall thickness will be 2 in. and over. In fact, for some dies it may be anything up to 8 in. at the heaviest section. In the case of castings of this type working under severe conditions, as takes place in the hot piercing of steel billets, it is not sufficient to have superficial soundness in the castings after all-over machining operations have taken place. If any trace of undisclosed liquid shrinkage porosity is present somewhere in the wall of such a casting then it will fail prematurely by gradual collapse of the inner working surface. A suitable and reliable type of feeding head, combined with top running, is shown in this illustration. It is just possible, of course, in this case that there will be sufficient bulk of metal available if the casting is extended, taking advantage of the taper present, but to make certain it is worth the extra trouble to have a self-feeding head of the correct type. After all, the cost of parting off such a head is exactly the same whether it is flared as indicated or whether it is parallel.

Fig. 8 shows an incorrect method of making such castings. This may seem rather ridiculous and not likely to be encountered in actual practice, but an assurance is given that this is not the case. When a tapered bore sleeve or bush of this type is cast with the heavy section downwards, particularly when it is poured by bottom runners, liquid shrinkage defects may be depressed to within a short distance of the bottom, since the last part of the casting to solidify is located there.

Headstock Spindles

Figs. 9 and 10 show two methods of producing a high-duty cast iron lathe headstock spindle. Here, of course, is another case where very great care has to be taken to avoid any

FOUNDRY PRODUCTION PROBLEMS

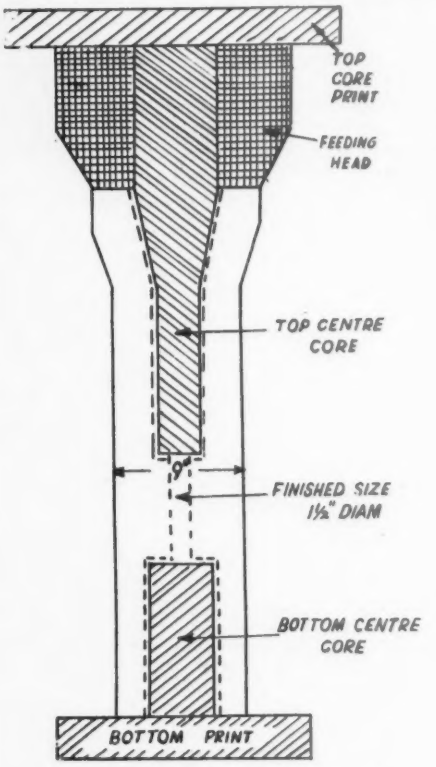

FIG. 11.—LATHE HEADSTOCK SPINDLE.

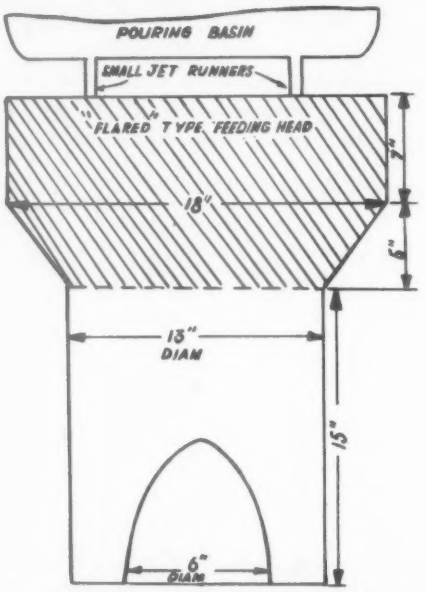

FIG. 12.—TYPICAL HOT HEADING DIE. METHOD OF CASTING NO. 1 (SECTION THROUGH CENTRE).

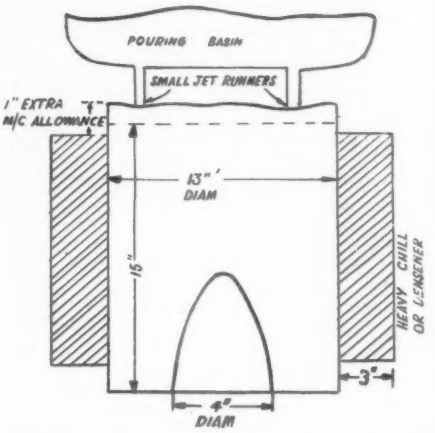

FIG. 13.—TYPICAL HOT HEADING DIE. METHOD OF CASTING NO. 2 (SECTION THROUGH CENTRE).

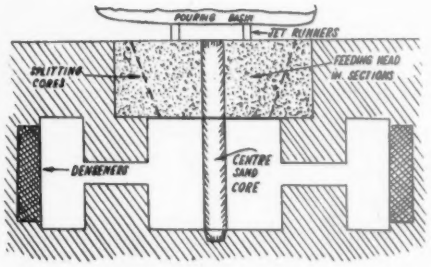

FIG. 14.—TYPICAL COUPLING.

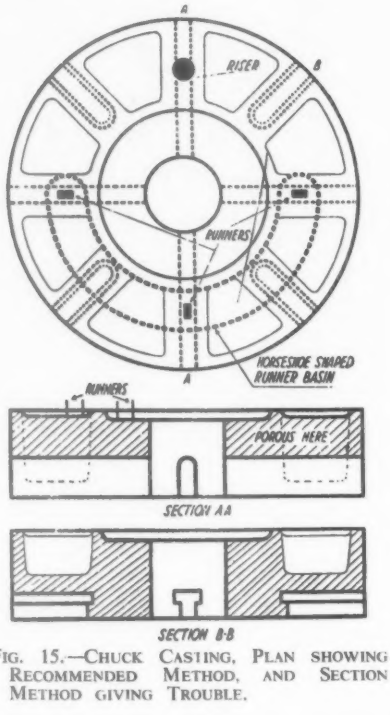

FIG. 15.—CHUCK CASTING, PLAN SHOWING RECOMMENDED METHOD, AND SECTION METHOD GIVING TROUBLE.

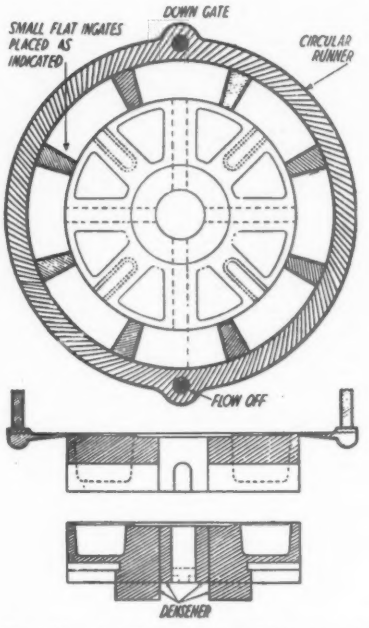

FIG. 16.—AN ALTERNATIVE METHOD OF RUNNING CHUCK CASTINGS.

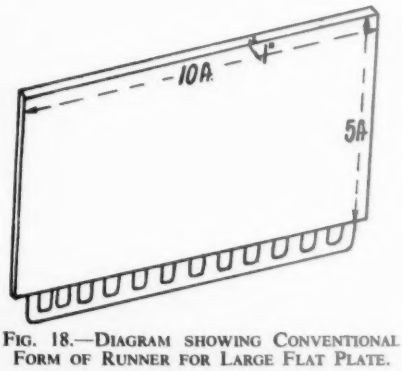

FIG. 18.—DIAGRAM SHOWING CONVENTIONAL FORM OF RUNNER FOR LARGE FLAT PLATE.

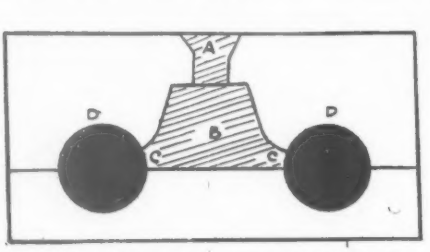

FIG. 17.—USE OF SHRINKBOB FOR SOLID BALL CASTINGS. SPRUE A DELIVERS METAL INTO ENLARGED RUNNER B. THIS FEEDS THE CASTINGS THROUGH THE MODIFIED INGATES C.

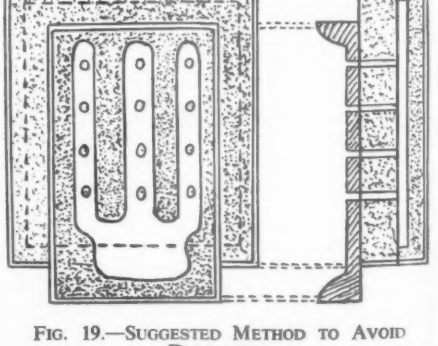

FIG. 19.—SUGGESTED METHOD TO AVOID DISTORTION.

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undisclosed porosity. The alternative material for such spindles is usually steel forgings, in which there is little risk of internal defects. Cast iron is very popular for this application on account of its rigidity, etc. Here again one has to cater by means of a feeding head to ensure freedom from liquid shrinkage porosity, but one must also consider a foundry technique which will prevent buckling of the core at the narrow neck. Fig. 9 shows the ideal method, but some foundries might encounter difficulty with core buckling, and as an expedient might resort to the method shown in Fig. 10.

Fig. 11 shows a similar type of casting where it has been deemed inadvisable to core out the middle portion which has a finished internal diameter of 1½ in. Some foundrymen may claim that it is quite easy to core out this job throughout its whole length, but when one considers the thickness of the metal involved it then presents considerable difficulty.

Fig. 12 shows a type of massive hot heading die, also for steel forging operations. The castings for this application are usually encountered in various sizes, and consist of what might be termed a large lump of cast iron in diameters up to probably 24 in. The working part of the die-face proper is only a very small portion of the casting, yet complete soundness in the whole mass of the casting is absolutely essential, even in high-duty iron if it is to stand up to the required conditions. This method shows the simplest and most foolproof method, but it has disadvantages in the cost entailed in parting off a large feeding head. Fig. 13 shows an alternative method of casting using heavy denseners.

Lumpy Castings

Very often one encounters difficulty with simple lumpy castings, such as couplings, which have to be made in cast iron of high tensile strength, and have to be completely sound throughout their whole mass. In extreme cases it may be necessary to adopt the feeding head method, but very often there is great difficulty in parting off such feeders. Unfortunately in cast iron they cannot be removed by oxy-acetylene cutting as is the case in steel castings, where the adoption of similar heads is being practised.

Fig. 14 shows a method which can be used to overcome this. The feeding head is split into four or more segments by means of splitting cores usually about ¼ or 1 in. thick. They do not interfere to any great extent with the feeding properties of the head, and yet they allow of the segments of the feeder being removed by hammer, heavy ball or similar methods.

Machine Tool Chuck Castings

Figs. 15 and 16 show alternative methods for running typical machine tool chuck castings in high-duty cast iron. Wherever possible all circular castings, which are required not only in high strength cast iron but which have to be completely free from porosity, should never be run from one individual point. Methods of running should be studied very carefully to permit as equal distribution of the metal in the mould as possible, always keeping in mind the principle of superheating the thin portions and speeding up the rate of cooling of the heavier portions. Very often it is necessary, in order to cool heavy portions more rapidly, to have recourse to denseners, but these should only be used where the design or other circumstances make it impossible to use self-feeding heads.

Shrink bobs are more often associated with the production of malleable iron rather than grey cast iron, but they can be and are used effectively to promote soundness in small lumpy castings, particularly where these are being machine moulded from a number of patterns on a plate.

Grinding Mill Balls

Fig. 17 shows a very simple example used in the manufacture of ball castings for grinding mills, which are usually made either in ordinary white iron or in martensitic Ni-Hard white iron. This material shows considerable liquid shrinkage, and if grinding balls are to be efficient in service they must be completely sound throughout their whole mass. Obviously spherical castings of this type tend to solidify from the skin inwards, and eventually leave a hollow cavity in the centre. Also in high-duty and other types of grey cast iron the same principle can be used to advantage for small, solid cylindrical castings, which must be completely non-porous in the centre to allow for deep machining and drilling operations without showing signs of even the most minute porosity.

Large Flat Plate Castings

Fig. 18 shows the typical method usually adopted in the production of large flat plate castings. The illustration is meant to give some idea of a plate 10 ft. by 5 ft. by 1 in. thick, the top, of course, being covered. Running from one side as illustrated tends to cause warping and buckling, as well as lack of uniformity and irregular hardness throughout different parts of the plate, by reason of the fact that metal reaching the points most remote from the runner cool at a different rate to those in close proximity to the runner.

Fig. 19 shows diagrammatically a much more desirable method of running these plates, with small drop ingates distributed over the top surface in such a way as to promote progressive solidification. The illustration, of course, is only diagrammatic, and in actual practice the openings of the downgates from the runner basin would be plugged or covered with dross plates to keep a sufficient head of metal and also to prevent slag and dross from entering the gates.

The same principle can be applied to large bedplates, lathe beds, drillings and milling machine tables, etc. This method of running from the top, either from a central point or at equally distributed points over the top area, will not only give greater freedom from liquid shrinkage porosity in such castings, but will also notably reduce the camber by eliminating unequal cooling rates, with consequent reduction of residual internal stresses, etc.

Fig. 20 illustrates a carbon-dioxide pump body casting required to be pressure tight under high liquid and gaseous pressures. At first sight the feeding head seems enormous and out of all proportion to the remainder of the casting. The material used for this casting is of the 30 tons per sq. in. tensile strength nickel-molybdenum type of cast iron. The only alternative material available for these castings would be an almost solid steel forging, in which cast iron liners would have to be inserted in the bores. With high strength cast iron the inherent properties of graphitic material are at once available, and the strength of the body is quite adequate for the duty entailed. The extra cost of removing the large head is more than amply compensated for by the fact that it is possible to cast the working parts of the component reasonably near to size, thus reducing the cost of machining operations on the casting proper.

Fig. 21.—Condenser End Header showing Heavy Feeders.

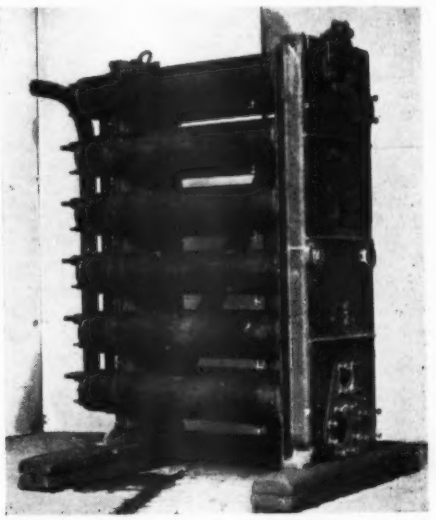

Fig. 22.—Ni-Resist Condenser Headers.

The above examples are put forward merely with a view to giving general indications and tendencies and, of course, are extremely elementary and simple in themselves. However, as already emphasised, these methods can be applied to large and complicated castings either individually or in various combinations.

Feeding Special Irons

Space does not allow of discussing running and feeding methods as adopted in the more specialised types of alloy cast iron. Perhaps it will be enough to say that, as far as intermediate alloy irons are concerned, for example grey martensitic irons and white martensitic irons, no special precautions are necessary, and methods found suitable for ordinary grey iron castings in the case of the former and for ordinary grey iron castings in the case of the latter can be successfully adopted. No attempt will be made to deal with the high silicon irons, which require a special technique of their own due to their peculiar properties. A few indica-

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tions might, however, be profitably given concerning foundry technique for the production of austenitic cast iron.

Taking Ni-Resist containing approximately 14 per cent. nickel, 7 per cent. copper, and 2 per cent. chromium as typical of these irons, the main points requiring attention from the moulding, coremaking, and running aspects are as follow: In general terms Ni-Resist austenitic cast iron should be poured at higher temperatures and more rapidly than is the case with grey iron, because it sets more quickly. Efforts should always be made to arrange the layout of the work in foundries handling Ni-Resist in such a way that the moulds are poured as soon as possible after tapping of the metal is completed. Green- or dry-sand moulds may be used in exactly the same way as for other types of special cast iron, the choice being left to individual producers, bearing in mind the size and mass of the castings.

The pattern shrinkage allowed for Ni-Resist is greater than that of ordinary cast iron, the amount usually necessary being $\frac{5}{32}$ to $\frac{7}{32}$ in. per foot. Because of the linear shrinkage characteristics of Ni-Resist, castings containing large or complicated cores should be constructed in such a way as to be easily crushable. In many cases it may be necessary to relieve or dig out such cores or parts of cores in order to relieve stresses and avoid cracking. This is achieved in the usual way, and care should be taken with the larger sized cores that core irons and similar reinforcements are kept sufficiently remote from the skin of the core that they will not impede contraction.

The fluidity of Ni-Resist is good and the metal holds its life well in the ladle, but its comparatively low total carbon content may make it set rapidly in the mould. Therefore the dimensions of the ingates should be large, so that rapid pouring can be accomplished. This should be achieved rather by the use of thin, wide gates, than attempting to get the increased area into individual square or circular section runners. By the use of thin, wide gates, the advantages of pouring rapidly can be obtained without risking the possibility of liquid shrinkage defects or, alternatively, openness of grain which is often found where heavy section gates join the castings.

The liquid shrinkage characteristics of Ni-Resist approach those of steel, and, therefore, in order to obtain castings free from liquid shrinkage porosity defects, it is necessary to use steel moulding type of feeders. High ferrostatic head pressure will also assist in densifying heavy sections. Denseners may also be used to equalise cooling rates, exactly as is the case with grey-iron castings. Even with the use of denseners, however, in most cases it is desirable to resort to heavy feeders.

Use of Chaplets and Studs

One other word of warning concerns the use of chaplets or studs for core anchorage. Where it is necessary to use such core anchorage devices, the chaplets should be made of Monel metal, so that uniformity of composition of the casting may be maintained. However, as in the case of high-duty and high-strength iron castings, the use of chaplets should be strictly limited to cases where all other alternative methods of core anchorage will not give the desired result.

The cleaning and fettling of Ni-Resist castings does not call for any special comment, except that the iron is not hardened by being exposed to air after solidification. Therefore, the castings may be shaken out at an early stage after they have become set. Runners and risers can be removed by the same practice as is used in the fettling of ordinary grey-iron castings. Clean-

(*Continued in next column.*)

(*Concluded from previous column.*)

ing in tumbling barrels should, however, be avoided, since such a procedure may tend to cause hardness on the skin due to work-hardening effects, and thus introduce machining difficulties.

The feeding heads for such castings, as already explained, should be on the lines usually recommended for steel castings and call for no special comment, except that they must be sufficiently large to provide ample liquid feeding metal for the area of the casting which they take care of.

Fig. 21 shows a rather extreme example of the use of heavy feeders on a condenser end header. The casting has to be pressure tight and incorporates a horizontal baffle of metal through the casting. Fig. 22 shows the same casting after machining and erection in the cooling unit of which it is a component.

World Directory of the Enamelling Industry

Although this publication is not procurable at the present time, attention should be called to the appearance of the 13th edition of the "Weltadressbuch der Emaille-Industrie," or World Directory of the Enamelling Industry, issued by "Die Glashütte," Dresden. This volume of 160 pages contains lists of enamelling works with notes of their products, range of output, trade marks, etc., arranged in groups covering continents and individual countries; lists of suppliers of enamelled ware, and of the principal makers of enamelling machinery, equipment and materials. Previous editions covered Europe only, but this latest issue has been expanded to cover all parts of the world.

Tin Smelting in South Africa

According to a recent report, a complete scheme for the establishment of a tin-smelting plant in the Union has been submitted to the South African Minister of Mines. South Africa has several promising tin-bearing areas and a few producing tin mines, and has always severely felt the need for a tin-smelter. It is suggested that if such a plant were established, tin production could be materially increased. During the last war, the smelter of the Zaaiplaats Tin Mining Company, Limited, which smelts its own concentrates, began smelting tin for consumption in the Union. The venture proved successful during the war period, but was discontinued in 1921, when conditions returned to normal. Smelting was also carried on at Leeuwpoort during the last war, but was abandoned soon after, though reintroduced for a short period in 1922, when low-grade concentrates were smelted. The value of the metal produced was £68,000. The economical smelting of tin in South Africa during the last war was made possible by the disparity between the Straits price and the London price of the metal. It is not urged that from an economic standpoint the proposed tin-smelting plant hardly seems to be warranted, though strategic reasons may favour the project.

New Alloy Bonds without Use of Flux

A new metal alloy, Galvalloy, recently introduced by Metalloy Company, of Los Angeles, is reported to obtain a perfect soldering bond with aluminium or aluminium alloys without use of flux of any sort. It also is said to bond practically all types of metals allowing the bonding of aluminium or aluminium alloys to these metals. In using the material, the surface to be coated or soldered is heated with a welding torch to about 600 deg. F., then a stick of the alloy is applied directly to the heated surface. Next a stiff wire brush is used briskly in all directions until a bright finish is secured. If a heavy deposit is desired, after the initial bond, more material is applied and agitated with a paddle or wire brush until the required thickness is obtained. The alloy can be used for many purposes, and in foundries where aluminium castings are made for filling blowholes or defects. It also can be used as a protective coating on welded seams or other areas where a non-corrosive coating is needed.

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(*Concluded from page 246.*)

repeating work touched the fundamental problem of the central organisation, or at least supervision, of research. In many cases, a repetition of research was desirable to confirm or refute experimental results, but in the future, with scientific research becoming still further part and parcel of the organisation and ordering of the post-war world and absolutely indispensable if the mistakes of the past are to be avoided and human welfare become dependent on something more than the ill-formed theories of non-scientific men, research of the essential problems of science and technology must be organised on a world basis. Such organisation presupposed the free, rapid and full interchange and dissemination of information, a principal medium for which was offered by a comprehensive and regular abstracting service. Abstracting was not an end in itself, but a tool in furthering research and disseminating the sum-total of human knowledge among the greatest number.

Time Lag in Publication

The time lag between publication and presentation of a Paper and its diffusion by means of an abstract, as emphasised by Mr. Delport, was indeed of the greatest importance. There were examples of abstracting bodies, well organised and presenting a good survey of their chosen field, which had published their reviews of literature up to six years after the first appearance of the Papers noticed, a time lag which became so disconcerting that radical reorganisation became imperative to rescue the reviews from becoming historical surveys only. To speed up the diffusion of Papers read before societies and institutes, some closer co-operation between these bodies and the publishing media is essential.

Both Mr. Delport and Mr. Currie desired to see the results of scientific work placed before the non-scientific worker in a more palatable form. The lack of this in the past and at the present time was responsible for much misunderstanding and scepticism among practical men of the utility and fruits of research, apart altogether from the very deplorable ignorance of the man in the street of the most elementary scientific matters. In the metallurgical field, as in all other scientific fields, the bridge of understanding between the research worker and the practical man must be brought by the preparation of suitable digests by authoritative hands and their publication in a suitable form. The technical institutes would appear to be the best fitted for such work, and experiments in this direction might profitably be undertaken by special committees set up by the present Institute.

Acknowledgments

In conclusion, the author desired to acknowledge the considerate assistance he has received in his researches from the Keeper of the Science Library, the Librarian of the Joint Libraries of the Iron and Steel Institute and the Institute of Metals, the Librarian of the Patent Office Library, the American Documentation Institute, and many other authorities and editors, too numerous to mention, as well as from Ilford, Limited, and Recordak, Limited, in regard to micro-copying and the reproduction of micro-films.

Counting Chickens

Last August, a monopoly concern was formed in Germany for the exploitation of the coal, iron and steel and foundry industries in the conquered parts of the U.S.S.R. The concern is empowered to close or dismantle any or all parts of a works, to lease out the works, and to transfer the control of works to other undertakings. The company itself is under the control of the Reichswerke, and comes within the ambit of the Reich four-year plan. The company will continue to function to the end of 1944, it is stated in the articles of association.

Metallurgical Literature

ITS CO-ORDINATION AND DIFFUSION

When this Paper* was presented to the London Branch of the Institute of British Foundrymen, it gave rise to an interesting discussion, during the course of which the necessity of rendering technical information easily available to workers in both the academic and more practical fields was stressed.

The discussion was opened by the Branch-President (Mr. R. B. Templeton), who remarked that Mr. Francis had given a most interesting Paper, but commented that one thing the author had not told them was how those people who had to work very hard were to find the time to read the abstracts he had mentioned, even if they could be condensed as they should be. In these days there was a very definite need for the further abstraction of abstracts, and he felt that the Nickel Bulletin did that very well indeed. These monthly bulletins gave abstracts which were of very great use to foundrymen, but there was one Institution which went even further than the Nickel Bulletin, and that was the Institution of Automobile Engineers, which issued their abstracts in the form of a sheet, and at the end there was a summary of the abstracts themselves. It was of very great value to readers, because every month there were some 40 or 50 abstracts, and it could quickly be seen which were of foundry interest. He personally examined them, and, whereas a subject such as the bearing temperatures of six-cylinder engines was not of very much interest, the wear of cast-iron brake drums was. An abstract of this sort he would take out and file; this was a very good method of obtaining abstracts of abstracts. There just was not time in these days to read through all the technical Papers that were published, as the number was simply overwhelming, and many of their interests were ignored. Incidentally, in present conditions there was the rationing of paper to be considered.

Defective Bibliographies

Mr. V. C. Faulkner (Past-President of the Institute) remarked that his translators always complained that most of the references in German publications were wrong. This applied to quite a high percentage, and it was always necessary to make a search to correct them. On one occasion the Germans published a textbook on foundry practice which contained a section on costing. There was only one reference to British work, and that was credited to America. Generally speaking, there was a high percentage of errors in bibliographies. At the moment he was receiving demands by every post for information with regard to costing, owing to the trouble contractors were having due to the fact that the various Ministries based purchase price on production costs, but there existed no unified idea as to how these costs should be ascertained. The result was that the Reports which the Institute published on foundry costs were very much in demand, and, personally, he needed at his side at the moment a bibliography of foundry costing.

There had been a great deal published which was misleading to the foundryman. What, for instance, was the definition of metallurgical work? There was an enormous amount of physical chemistry masquerading as metallurgy and Mr. Francis, in his various references, had shown how, although the number of journals had been cut down from the abstracting point of view, the same ideas had continued, until the question of abstracting abstracts and eliminating much of the material which was not metallurgy at all had had to be taken in hand.

* "Foundry Trade Journal," March 19 and 26, 1942

Eliminating Duplication

Perhaps there was one thing Mr. Francis had not stressed sufficiently, and that was that the utility of much of the abstracting was to stop people doing work that had already been done. He remembered that some years ago Dr. Everest carried out an excellent piece of research on the influence of aluminium on cast iron. At the time, the authorities did not like publishing this because the results showed no commercial significance, but it came under his notice and he decided to publish it because he felt the pundits had not looked at it from every angle. Several years later that research became extremely valuable because there was the one angle of heat-resisting iron which was revealed. This showed very clearly how valuable research could be through intelligent abstracting.

Although Mr. Francis had given a very large number of figures he did not reveal the cost of the American monographs on the ferrous alloys. Speaking from memory, he believed it was of the order of £5,000 annually. Personally, concluded Mr. Faulkner, he was exceptionally pleased with Mr. Francis' Paper, which had been extraordinarily enlightening. He was fairly familiar with foundry literature but he had to admit that he was unaware of the existence of 300 metallurgical journals.

Technical Press Reduces Time Lag

Mr. Delport said the question of the time lag between publication of a Paper and the time when it was available for the public in abstract form was an important one. It was serious for metallurgists because it was necessary for them to have the information available as soon as possible. Very often the Transactions of the various societies which held meetings were not published until, sometimes, six months after the reading of the Papers and therefore the Papers, for the purpose of abstracting, should be made available sooner. That difficulty was largely solved by the technical and trade journals that published these Papers almost in full immediately after the meetings had taken place.

This brought him to a point to which he attached most importance. He had always been a great believer in the very closest co-operation between the metallurgist or research worker and the practical man—the man who actually worked in the foundry. It was very important that the practical man should have available to him details of the developments that took place in the technical and scientific world. Obviously, the man who had not had a scientific training could not always follow the text of Papers which were read before scientific and technical societies and the substance of them should be made available in abstract form as quickly as possible.

On the subject of technical literature generally, he did not think sufficient emphasis had been laid on the importance of editing Papers in such a way that the man who was actually working in the foundry could get something out of them. At present there did not seem to be much alternative between reading the full text of the Paper as read before the particular society and a brief abstract which sometimes did not induce such a man to want to try and learn more about the subject. Very often such a man was unable to follow the original Paper. It was true there were some publications which published digests of such Papers, which were extremely useful to the man who had not had a scientific training, but there was not enough of that being done and there was room for some digest of these Papers to enable these men to keep more in touch with what was going on in the scientific world and this, in itself, would lead to a closer co-operation between the metallurgist and the practical man.

Mechanism of "Abstract" Preparation

Dr. A. B. Everest said the author had given an excellent review of the problem of handling the enormous amount of technical literature published in these days, and everybody must be convinced of the necessity for abstracts, as no one had the time to study all the original publications. There was one small point in this connection which was worth further consideration, and that was, who was the ideal man to make the abstract? In his view, the best person was the author himself. That was done in the case of many of the American Papers; the author wrote his own abstract, and if that practice became universal, it would be a great help to everybody.

A good deal had been said about the preparation of abstracts of abstracts and the problem of getting hold of bibliographies. The fundamental difficulty there was that a bibliography was a very specialised thing, and it was necessary to know just where to get it. No mention had been made of "Aslib"—the Association of Special Libraries and Information Bureaux. That was a large organisation in this country which was not so well known as it should be. It was a technical organisation, drawing together all the various specialised libraries and acting as a kind of clearing house for specialised information. If one wanted a bibliography on a particular subject, "Aslib" was the place to go for it. This seemed to be a rather important omission from the Paper.

Another point which might perhaps be mentioned is that behind all services connected with abstracting and collecting of information and the preparation of bibliographies there must be an efficient and carefully maintained indexed system of references. It is not perhaps always realised what a tremendous amount of work is involved in maintaining such an index so that it shall always be complete and up to date. The author has made an appreciative reference to the Nickel Bulletin, and in illustration of the point mentioned here it can be stated that behind the Nickel Bulletin, and the Technical Information Section which is responsible for the preparation of the abstracts, lies a card index system consisting of something like a quarter of a million cards. This index represents years of work, and presumably is typical of systems which must be maintained by all other specialist authorities on particular branches of metallurgical and engineering practice.

Periodic Indices

Mr. J. Ferdinand Kayzer said that the point made by Mr. Faulkner as to the value of abstracting to prevent unnecessary work, and the one made by Mr. Delport with regard to editing, were both most important. The implication from Mr. Faulkner's remarks was that, if one did not want to repeat anything done before, a search should be made of the patent literature, and one should not work on the assumption that a survey of that would ever be out of date. Actually, it was never out of date. The earliest metallurgical publication, if one excluded the classics, was Agricola's "De Re Metallica." At the present time, if he were starting a new research on iron or steel—and that was a very wide term in these days—he would refer to the patent literature of the world.

Another matter was that every journal should have a good index, and not only an annual index, but an index every five or ten years. That would be a great advantage. The Iron and Steel Institute was not bad in this respect, but the Institute of Metals was the reverse. Some years ago they started a name index. Whether or not it was interesting to anybody was another matter, but what was certainly wanted was a subject index. In any case, every journal

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should have an index every five or ten years, in addition to an annual index.

A Word of Warning

Mr. A. J. Murphy (Institute of Metals), referring to Mr. Kayser's remarks, said that the service of abstracts relating to non-ferrous metals provided by the Institute of Metals was the finest in the world. The Institute was aware of the necessity for a periodical index, and was working hard on that subject. If it were to be done well it was a colossal job.

It had been a great pleasure to have so comprehensive a Paper from Mr. Francis. There was a danger in the suggestion that abstracts were valuable in guarding investigators against the risk of repeating work that had been done before. If this were carried too far it would lead to the perpetuation of errors in earlier research work. Discrimination must be used in accepting as correct the information contained in abstracts or even in the original publication, to which reference should be made wherever possible.

Suggested Publicity Advisory Bureau

Mr. E. M. Currie, after congratulating Mr. Francis on a most masterly analysis of this subject, said he had been wondering whether the Institute, or even the Branch, could establish a small Committee who would advise members with regard to those abstracts of most interest to them. There was no doubt that the abstract services which most foundrymen had access to covered far too wide a field for the average individual, perhaps for the reason that the majority of these services were commercial propositions. Even to wade through the items contained in one abstract service was enough to give one mental indigestion, and usually one was left with the feeling that maybe just the item needed had been omitted because one was mainly dependent upon the opinion of the reviewer whether the article should or should not be included in the abstracts. The main interests of the active members of each Branch could be fairly well defined, and a "Publicity Advisory Committee" having access to most abstract services could thus, by merely listing the items meeting these main interests, be doing a real service to the Branch members in these extremely busy times.

Possibilities of a Central Bureau

Mr. N. B. Vaughan, after remarking that he thought the Paper gave an extremely comprehensive and balanced view of the position, said he thought that the change of policy of those responsible for the abstracts in "Metals and Alloys," to which several references had been made, was not to be looked upon as in any way foolish. To attempt to abstract all articles and Papers of metallurgical interest published throughout the world was a very heavy task, and "Metals and Alloys" might well believe that to give summaries of selected Papers was of greater service to the majority of readers than to give brief abstracts of a much greater number of Papers.

Mr. Francis had touched upon the need for greater co-ordination between the many abstracting organisations that exist. It was, therefore, interesting to note that some steps had been taken in this direction even since the outbreak of war, when circumstances might not be regarded as propitious for such a project. A committee had been set up under the auspices of the British Society for International Bibliography to see what measures of co-operation might be taken. One of its objects was to try to avoid the present waste of time and effort that was involved in the searching of the same journal (such as, say, the "Journal of the Chemical Society") by many different abstracting bodies for Papers of particular interest to themselves. It had been suggested that it might be feasible for all scientific and technical periodicals to be allocated by a central bureau for purposes of search among the various abstracting organisations, according to their primary interest. Each organisation, besides making its own abstracts, would inform the other organisations, *via* the central bureau, of what Papers they should also abstract; and they themselves in turn would be informed of Papers in their own particular field that had appeared elsewhere. This scheme, admirable in theory, would depend for its success on at least two factors; firstly, a thorough knowledge by each participating body of the requirements of the others; and secondly, the existence in each branch of science of an adequate abstracting organisation. At present the latter condition did not prevail; for example, engineering sciences in this country were at the moment poorly served, and a big gap would therefore be left in the co-operative scheme outlined, one indeed which was likely to prevent its being put into effect at an early date.

AUTHOR'S REPLY

Mr. Francis, replying to the discussion, said it would be impossible to answer them in detail at the moment, and he would prepare a written reply. One speaker had asked about the best way to find out what had been done in a particular metallurgical subject. If he could define his "particular subject" sufficiently, he should be able to determine whether he needed the abstracts of the Iron and Steel Institute or the Institute of Metals, but it would mean a search. He might also get into touch with "Aslib" and find out whether anyone had already prepared a specialised bibliography on the particular subject. He believed it was true to say that in 95 cases out of 100 it would be found that a bibliography had not been published. Then contact might profitably be made with the Science Library, which for some years had been making a list of bibliographies. It was difficult to give more precise advice without knowing the particular subject.

He agreed with the speaker who mentioned the quality of the Iron and Steel Abstracts. In this he included the quality of the Institute of Metals Abstracts. In preparing the Paper he had considered the internationalisation of abstracting services, but a study of the abstracts of the Iron and Steel Institute and of the Institute of Metals had shown that, at least in the metallurgical field, such a suggestion would have been out of place and implied that the field was not being adequately covered. These two Institutes were doing the job so well that no international body could do it better. It was a matter of great surprise that the Americans had not been able to produce anything that came up to this standard. "Stahl und Eisen" published bibliographical data with a few captions, but there was little indication of what Papers contained; the result did not bear comparison with the British abstracting services. It would appear, therefore, with regard to internationalisation, that the two Institutes and the British Non-Ferrous Research Association should co-operate to produce world ferrous and non-ferrous abstracts. In the field of chemistry, Great Britain, America, France and Germany had independently built up a fine mass of chemical abstracts, which was bewildering to contemplate, remembering the work that had been done to produce these abstracts.

Manual for Authors

It was quite true, as Dr. Everest had said, that the best abstractor of a Paper was the author himself. There were certain standards which should be followed in writing and abstracting Papers. Both the Institution of Mechanical Engineers and the Institute of Metals gave advice to would-be authors and he believed there were one or two books dealing with the subject. A manual might be produced which gave authors a course in composition and in the compilation of Papers, and it might contain a chapter on how an author should abstract his own Paper. This might also help to remove many of the cobwebs about a particular contribution which a writer might think would be useful for publication. When one had written a Paper it was always possible to see the things that had been omitted and how badly it had been arranged. If one had to abstract the Paper as well, it would be possible to get a better idea of its value and whether the information and ideas it was wanted to express had actually been purveyed in a manner which could be assimilated by anyone reading it.

Room for a New Service

With regard to "Aslib," mentioned by Dr. Everest, this covered a vast field and a very large number of organisations which maintained their own private bibliographical services, largely for their own commercial ends. He had, therefore, deliberately left out any reference to it in the Paper, where he was not thinking of this type of service at all. What he had in mind was the means of rendering the world's literature available to the men who wanted it. The editor's job was to produce an article and publish it and give the author benevolent advice when he needed it. The libraries' job was to collect, classify and collate the published literature of the world. Neither the editor nor the librarian had the job of thrusting information before those they thought should have it. There was room for a new service, and it was one which could be covered by intelligent abstracting, and by annual or periodical surveys such as made by Alloys of Iron Research, which he confirmed cost £5,000 annually. One could not expect the ordinary founder or moulder to understand the very technical Papers in the Journal of the Institute of Metals, but there were organisations which had overcome similar difficulties. The Safety in Mines Research Board, whose work was sometimes extremely academic, made the results available to the collier, a very intelligent but by no means well-educated man scientifically, in a series of publications called "What a Mining Man Ought to Know," price 3d. These gave the results of the latest research on a specific subject in a simple manner so that the miner could draw his own conclusions. There was room for something on like lines in the field of applied metallurgy.

Reference had been made by Mr. Kayser to the patent literature. That was a subject he had purposely excluded, because it was a field of its own entirely.

Written Reply

In his written reply, amplifying his reply at the meeting, the author called attention to Mr. Templeton's comparison of different methods of presentation of abstracts; this merely emphasised the need for some standardisation in preparing and classifying abstracts, and also reviews of them. Much remained to be done in co-ordinating the periodical literature in view of its rapid growth and vast volume, far beyond the ordinary worker to survey rationally and with profit. Mr. Vaughan's reference to the work of the British Society for International Bibliography was therefore interesting, as well as his outline of the many difficulties involved. While co-operative arrangements between small numbers of abstracting organisations have been found to work within a limited sphere, the extension of these arrangements to national and even international spheres should eventually be realised for the maximum degree of co-ordination. It does not seem that the desiderata laid down by Mr. Vaughan should be incapable of fulfilment in course of time, for the survey of the scientific and technical literature cannot in the future be left to the hazards of undisciplined evolution.

The question raised by Mr. Faulkner that abstracts should aid in preventing investigators

(*Continued on page* 244.)

The Foundry Industry and Air Warfare

II—THE MANUFACTURE OF CAST STEEL BOMBS

The marching song, "Bomben über England" is now about as *demodé* in Germany as "Hanging Out the Washing on the Siegfried Line" is in this country. The Germans have good reason to appreciate the efforts which have been, and are being, made in British steel foundries to provide the R.A.F. with ever-increasing quantities of steel bombs.

The manufacture of steel bombs is undertaken by quite a number of concerns, and all methods of moulding are used. Some are made on the flat, some nose-up, and others nose-down. The method chosen to be described is the latter one as applied to the 500-lb. size, and this choice has been made, not necessarily because it is either the cheapest, or the quickest, but rather because it is "extremely reliable." Moulding on the flat is in many ways better for mechanised production. The foundry where the method was originally created, though still using hand methods, is getting a very high production per square foot of shop floor.

Pattern and Corebox Making

The pattern, shown in Fig. 1, is made of Duralumin, or the like, in two halves, carrying in general about 1 in. thickness of metal. Internally there is a reinforcing plate, through which passes a steel eye-bolt for its withdrawal from the mould. The contraction allowances are adjusted to meet those actually encountered in the foundry. There may be a slight variation according to the steelmaking process used. So made, the patterns, though subject to rigid inspection, are giving an excellent life. The corebox, also made in Duralumin, is constructed in three sections, as is shown in Fig. 2, provision being made in the bottom box for seating the core bar.

Core-Making

The core barrel is constructed from 2⅛-in. o.d. mild-steel tube perforated with a quantity of ¼-in. dia. holes. It is wrapped on a simple treadle lathe with coarse straw rope. The practical minimum amount is one and a half layers, the half, of course, corresponding to the region of maximum diameter of the core. After winding, the barrel is charred over a brazier to eliminate the straggling end-bits and the natural waterproof oils, which the surface of straw carries, so as to obtain good adhesion with the loam sand. Before doing this, however, the barrel is taken to a bench, where the end is plugged and a ferrule fitted. This ferrule is destined to become integral with the nose of the casting and to be machined out. On the end of the ferrule is jam-fitted, by means of a short length of lamp wick, a cap, which is salvaged and re-used. This assembly is shown in Fig. 3.

The core barrel is then centred in the corebox, visual control being sufficient to keep it vertical whilst ramming up with sand. After drying, the cores are either painted by hand or sprayed with a mixture containing silica flour, core cream and bentonite. A simple device is usually constructed for transporting the cores in pairs or groups to the moulding floor by overhead crane.

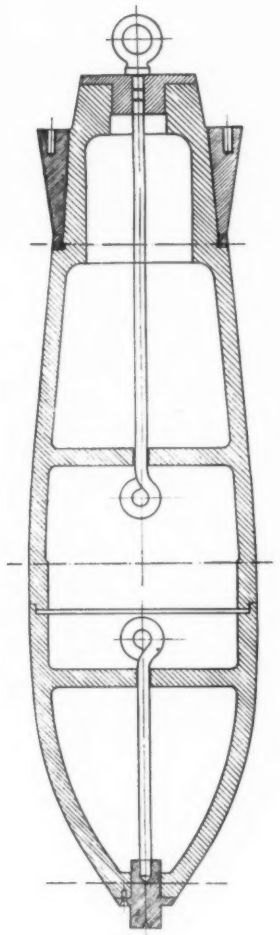


FIG. 1.—TYPE OF METAL PATTERN USED.

Moulding Methods

It is obvious that special attention must be paid to the box parts, as the knocking out of the bombs involves fairly rough usage. The writer sometimes wonders whether a simple knocking-out machine, built on somewhat similar lines to the ingot mould stripper of the steelworks could not be devised for foundry use, where but few sizes of boxes are constantly re-used. The boxes used on one foundry are shown in Fig. 4, from which it will be seen that though the bombs are a two-parted job yet the method uses three boxes, two for the bottom half and one for the top. Alternatively, the top half can be constructed of three boxes of the type used for the bottom half.

Fig. 5, showing the bottom half-box for taking two patterns, discloses in fair detail the method of moulding followed. On a board are set the pattern, the two horn runners, and four sockets. These sockets are used instead of box pins for aligning the top and bottom halves of moulds. The top half-box carries a ball joint, and the details of this very useful device are shown in Fig. 6. When ramming reaches the top of the pattern, a fire-clay ring is superposed on it automatically centred, and any distance between that and the top surface is built up with packing. At a point between the end of the down runner and the pattern a large brad is

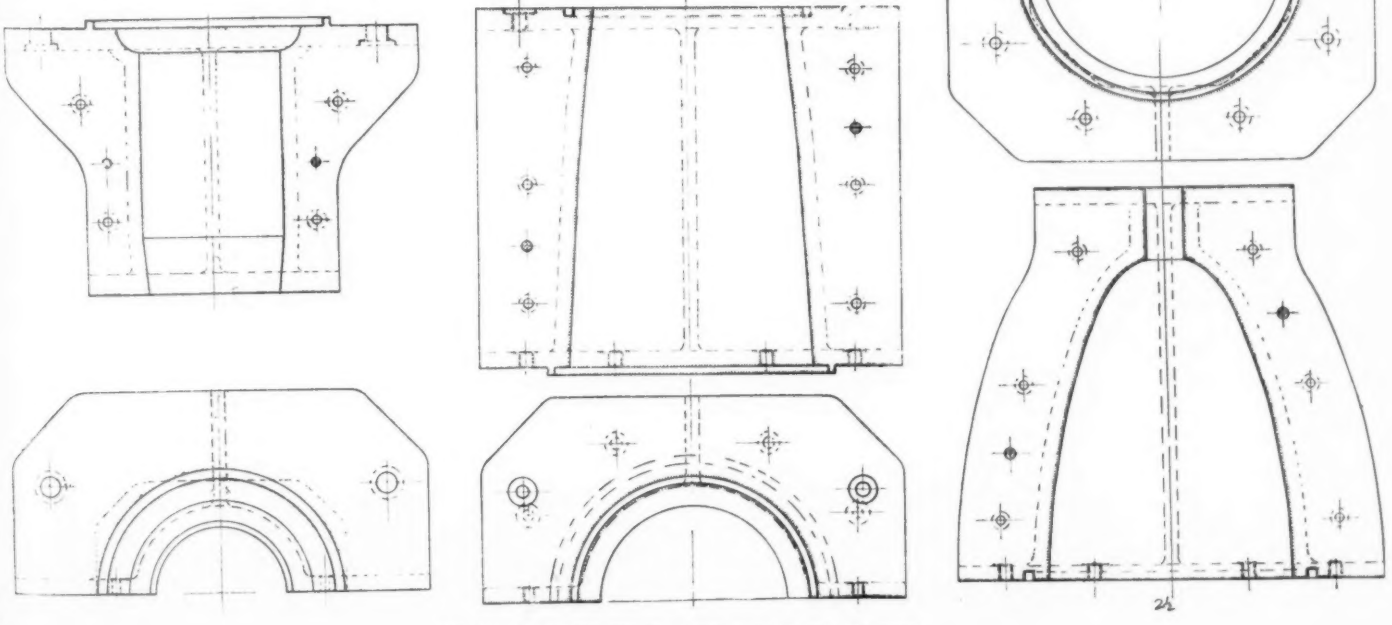


FIG. 2.—THE COREBOX IS DIVIDED IN THREE SECTIONS.

Foundry Industry and Air Warfare

inserted to reinforce what would be a weak spot. A grid is bolted to the box, which is rolled over, and the surfaces are cleaned up.

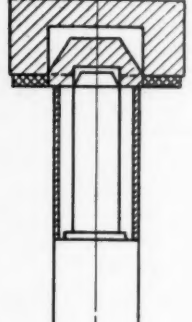


Fig. 3.—Details of the Ferrule Assembly.

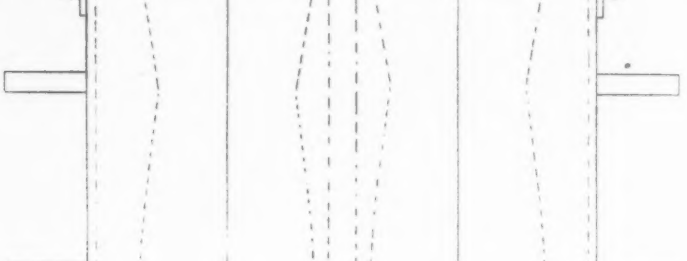
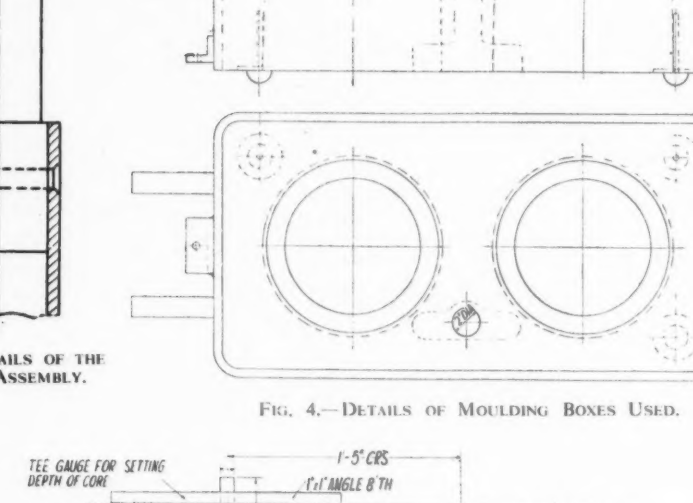


Fig. 4.—Details of Moulding Boxes Used.



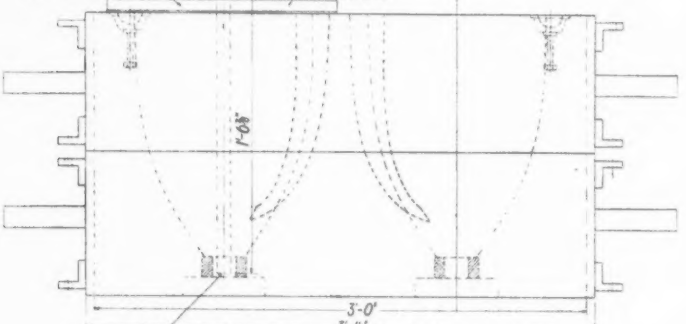


Fig. 5.—Bottom-Half Box for Taking Two Patterns.

The top half pattern having been set in position together with the ball joints, the top box is lowered and the common down-runner stick for the two horn runners set in position. The ramming is carried out as is indicated in Fig. 5. The mould is now taken adrift and the sections of the pattern removed. When the job is properly in production no nailing should be required, but it is advantageous at points where the metal strikes against the core in the experimental stage.

Mould Assembly

Among the points to be noted when assembling the mould is that the core is centred at bottom by the ferrule on the barrel and by a clay ring in the mould. It is centred at the top by a gauge having three arms carrying distance pieces set at 120 deg. or by two semi-circular gauges fitting in the head portion. The correct height of the core is fixed by a shoulder gauge working from the mould joint. This method implies that the core barrel is not fastened down but is left free to expand. Fig. 7 shows clearly that the shoulder of the core is clamped down. Naturally all details such as the

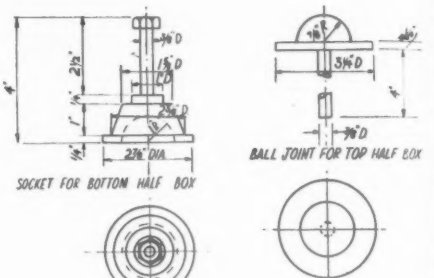


Fig. 6.—Details of the Ball and Socket Method Used for Centring Boxes.

assembly details, size of runner box and speed of running are all standardised.

A description of a hand method has been given because it discloses conditions which can be applied to mechanical production by the Sandslinger or on various types of moulding machine. The job, though relatively a simple one, is not foolproof, and constant attention needs to be given to the core so that it retains

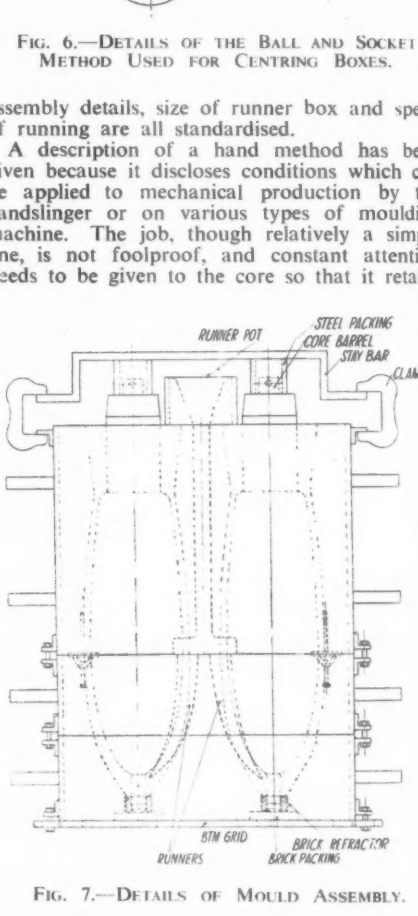


Fig. 7.—Details of Mould Assembly.

its permeability and collapsibility without being mechanically too weak.

The fettling on the 500-lb. casting presents little difficulty, as the apertures are sufficiently big to insert portable grinders and other tools. The inspection is pretty severe, especially as to concentricity, and the vertical method of moulding and casting nose-down does seem particularly satisfactory in this respect.

Ignitability of Coal

An extended investigation of the method and apparatus for the determination of the ignition temperature of solid fuels developed by the Coal Research Laboratory of Carnegie Institute of Technology is described by R. A. Sherman and H. N. Ostborg in a recent Paper read before the A.S.T.M. Chicago meeting.

Protection Against Industrial Dust*

By KENNETH L. GOODALL, M.Sc., F.Inst.P.†

Industrial dust presents two main hazards to the workers in factory and mine: (1) risks to health, 2) risks to life and limb through fire and explosion from certain types of dust. Many factory operations give rise to dust, the chief including crushing, breaking, disintegrating, grinding, abrading, drilling, sawing, turning, mixing, sieving, rumbling, sand- or shot-blasting, and almost any operation involving material which is itself a dust or contains a percentage of dust.

The risks to health from industrial dusts arise from the damage they can cause to the respiratory system, and from the action of certain dusts as general systemic poisons or skin irritants. Thus the inhalation of silica or asbestos dusts, which is cumulative in effect, can cause the incurable lung diseases of silicosis and asbestosis respectively, in which the lung tissue is gradually destroyed, with the result that blood aeration diminishes; the inhalation of animal or vegetable dusts, and of some mineral dusts such as limestone, glass, cement, marble, and emery may affect the respiratory passages and give rise to bronchitis, asthma, or catarrh. The breathing of certain metallic oxide fumes such as zinc oxide, magnesium oxide, manganese dioxide, and copper oxide, can give rise to metal fume fevers, while the inhalation or swallowing of certain toxic dusts such as lead, arsenic, cadmium, or manganese, and their compounds, leads to poisoning. Of these dangers to health the most serious are undoubtedly those due to silica and asbestos dusts and to the poisonous dusts such as lead.

Physical principles are involved at many stages in the estimation and control of dusty conditions in the working atmosphere.

Protection Against Industrial Dust

By a suitable combination of the physical and physical-chemical methods which are described in the Paper, a fair assessment of the amount and nature of the dust clouds being breathed by workers in any particular case can be made. Methods of protection to suit can then be devised. This is the ideal approach to the problem which can only be adopted at present in a limited number of cases on account of the time involved in such surveys. In practice a selective survey of dusty conditions associated with typical processes in an industry offers valuable guidance for more general application of protective measures to generally similar conditions in a whole industry.

In the normal individual the human nose, throat, and lungs in themselves provide a defensive mechanism for arresting fine dust and preventing its reaching the ultimate air sacs in the lungs. The nose traps large particles in the nostrils and finer particles in the maze of passages above the nostrils in which dust is deposited from eddy current action, particle aggregation, and from impingement on the sticky secretion of mucus which lines all the air passages from the nose downwards. The windpipe and air tubes of the lungs are also lined with minute whip-like processes known as cilia, whose function is constantly to sweep upwards to the windpipe for expectoration the mucus and the dust particles it has trapped, the process being aided by the rhythmic contraction of the smaller muscular air tubes. Fine particles which succeed in reaching the air sacs of the lung are attacked and ingested by phagocytic cells, some of which manage to carry the dust back into the air tubes where they can be expelled. The importance of nose breathing in dusty atmospheres, in order that all the natural defences of the respiratory system may be brought into full play, will be appreciated, though individuals differ widely in the power of these defences.

The main methods of protection against industrial dust take a wide variety of forms. The purpose of general ventilation is to dilute with fresh air the dust laden air liable to be breathed, so that the resulting dust concentration is below the toxic or otherwise harmful limit. Such ventilation can take two forms, the extraction system with wall fans removing the contaminated workroom air, which is replaced by warmed fresh air, entering through suitably disposed openings in other parts of the room, or the plenum system in which clean, warmed and possibly humidified air is blown into the workroom under slight positive pressure through a ducting system, the air finding its way out *via* doors, windows or other openings. These methods of dealing with dust in workrooms, or a combination of them both, are of strictly limited application and are only successfully applied where the dust concentrations are generally disseminated in the workrooms. Even then, the use of general mechanical ventilation is often a confession of failure to provide what is more effective, namely, adequate localised exhaust ventilation.

Localised Exhaust Ventilation

Localised exhaust ventilation is the commonest and most usually effective way of protecting workers against local dust concentrations. The basic idea is to capture the dust or fume as near as possible to its point of origin by means of concentrated air currents flowing into suitable exhaust hoods, which need to be designed on sound physical principles to suit each individual case. The collected material is sucked away through ducting by a fan and passes to filtration plant. It is found that most industrial dusts can be captured by exhaust hoods designed to produce a linear air speed of from 100 ft. to 500 ft. per min. at the point of origin of the dust.

Ducting resistance is an important item contributing to running costs, and proper application of the laws governing the flow of dust-laden air in pipes will enable resistance to be reduced to a minimum by securing a symmetrical layout of adequate sectioned piping, fed by branch ducts at small angles in the direction of air flow and provided with gradual bends, tapered connections to fans, cleaning panels suitably sited, smooth joints and the like. The type of fan used for dust exhaust systems is the paddle type, receiving the dusty air approximately radially and discharging it tangentially against resistances which may reach as high as 14 in. w.g. In many cases the fans are placed downstream from the air cleaning plant, which is thereby kept under suction, an advantage where filters are, against the best practice, sometimes located in workrooms. The fan itself also thereby handles practically clean air.

The main types of dust collecting apparatus are all based on physical principles and include gravitational and centrifugal settling chambers, inertial separators, viscous type filters, wet scrubber filters, bag filters and electrostatic precipitators.

Considerable use is also made of the wetting of materials to prevent dust creation, but Watson has pointed out that in certain cases this practice may be more dangerous than dry working. In some cases safe material may be substituted for dangerous dusty material, for example in the classic cases of the substitution of steel shot for sand in the operation of sandblasting iron castings, and of alumina for powdered flint in the process of china bedding in the pottery industry.

All dusty processes should, of course, be separated from other processes so as to limit the number of workers exposed to any particular dust risk. By what is called "good housekeeping" a great deal can be done to protect workers from dust; for example by widely spacing dust producing machines, by storing dusty materials not in immediate use outside workrooms, and by keeping plant and workrooms as clean as possible, preferably with the aid of vacuum methods of cleaning. The periodical medical examination of workers now required statutorily in a number of dusty industries is of great value, whilst much may also be achieved by the education of workers in the risks they run, and in their personal responsibility for preventing and suppressing dust clouds. A respirator of good design and with high filtering efficiency for low breathing resistance is useful as a secondary line of defence against dusty conditions.

Fire and Explosion Risks

The extent to which protection is needed against the risk of fire and explosion from many industrial dusts under certain conditions is not generally realised, yet such dust fires and explosions frequently involve serious loss of life and injury to workers, and extensive damage to factory premises and plant. Examples of dust liable to burn or explode under appropriate conditions are pulverised coal, sugar, dextrine, cocoa, various cereal dusts, cork, shoddy and rags, sulphur, wood flour, various resins and dyes and plastics, malt, tea, magnesium, and aluminium, to name but a few.

Oxidation of combustible material is a surface phenomenon, and so is most rapid and capable of causing explosion with material in the finely divided state, *i.e.*, with dusts, and particularly when these are in suspension in air as dust clouds. The increase of surface area with decrease in constituent particle size, for a given weight of dust, is striking. Thus Berger, on the basis of certain assumptions, shows that the surface of a cube of aluminium weighing 1 grm. is approximately 3 sq. cm., whereas if the cube is comminuted until the thickness of the resulting lamellæ is 20 μ (coarse stamped powder), the surface increases to 429 sq. cm. If the process is continued until the thickness of the lamellæ is reduced to 0.6 μ (fine stamped powder), the surface of the 1 grm. of metal becomes 14,290 sq. cm., while for the finest powder (prepared industrially in large quantities) with lamellar thickness 0.3 μ, the surface of a gramme becomes 28,570 sq. cm. The increase in intensity of explosion of dust clouds with decrease in constituent particle size is also of interest in this connection. Gliwitzky obtained the following figures from experimental explosions of three types of commercial aluminium pigment powder in a bomb of 53,000 c.c. capacity, for two powder concentrations.

Particle size. μ	Duration of explosion (sec.) for 700 mg. per l.	Explosion pressure (atm.). 700 mg. per l.	580 mg. per l.
1·2	0·06	7·7	7·7
0·6	0·03	8·6	9·2
0·3	0·012	10·6	11·6

The maximum pressure of 11.6 atmospheres for a powder concentration of 580 mg./l is higher than the maximum pressures recorded for the explosion of gas/air mixtures, including the hydrogen/oxygen mixture with which 9.7 atmospheres has been obtained. Pressures up to 18 atmospheres have been recorded for coal dust and flour explosions at certain concentrations and finenesses. Much greater values still have been measured for starch dust. The dangerous potentialities of the finely divided carbonaceous and metallic dusts for fire and explosion are manifest, since factory buildings, unlike mines, are not capable of withstanding such high pressures and rates of pressure rise. For each combustible material there is an upper and a lower limit of concentration and beyond these limits the material will not burn. Within these limits there is also a minimum temperature or "ignition temperature," below which the material will not ignite. Safety measures against dust cloud fires and explosions therefore aim fundamentally at keeping concentrations outside (and in practice usually below) the inflammable concentration limits, and avoiding sources of ignition; and if this should not be successfully achieved and a fire or explosion should result, one should aim at so designing the plant concerned and arranging the manner of working the process that there is a minimum of damage to workers and plant.

Electrostatic Charges

It is of interest, in connection with sources of ignition, to mention that electrostatic charges are known to be formed when powder issues from nozzles, or is blown into a dust cloud, or rubs frictionally against machine surfaces. Belts running over pulleys also accumulate charges. Discharges of such accumulations may ignite dust clouds, and although very little is known about this danger, it needs to be taken into account. Safety measures take the form of keeping the air as humid as possible, or in special cases ionised, using electrically conducting belting or suitably earthed collectors, and of bonding all plant to earth to prevent accumulation of charges. It has also been claimed by Wolf that, where aluminium foil or powder is produced, it can be ignited not only by fire and sparks, but also by the effect of light.

In the case of grinding particularly dangerous dusts, such as magnesium, the only safe practice is to prevent any worker being in the mill room whilst grinding is in progress, to which end the grinding mill door should be so interlocked with the electrical control to the grinding mill motor that, unless the door is shut, the grinding plant cannot be set in motion, and the door cannot be opened until the current has been switched off and the mill has come to rest.

* Extracts from a Paper in the "Journal of Scientific Instruments," March, 1942.

† H.M. Engineering Inspector of Factories.

Air-Conditioned Blast

SIX MONTHS' EXPERIENCE

It is quite well known that the idea of conditioning the blast supplied to iron-smelting furnaces is not new; in fact, it was originally tried out in America as early as 1904 but was abandoned because of its high cost. Nothing further along these lines seemed to be done until 1939, when the Woodward Iron Company, of Alabama, installed a pre-compression chilled water system on one of their blast furnaces to eliminate the high and widely fluctuating humidity in the atmosphere which interfered with the uniform and smooth working of their furnaces. The object was to maintain a constant moisture content of 3 grains per cub. ft. The results achieved were so satisfactory that the Woodward Company installed air-conditioning equipment on two other furnaces.

According to Mr. E. K. Miller, assistant general superintendent at the Aliquippa Works of the Jones & Laughlin Steel Corporation, writing in "Blast Furnace and Steel Plant," the satisfactory performance of the air-conditioning unit at the works of the Woodward Iron Company was a factor that influenced the installation of a pre-compression chilled water system on one of the large blast furnaces at the Aliquippa Works. On April 2, 1941, a pre-compression chilled water system was put into operation on one of their five blast furnaces to obtain first-hand information as to the benefits that could be expected by reducing and controlling the moisture content in the blast air. This furnace, designated as No. 1, has a hearth dia. of 28 ft. 6 in., a stack height of 90 ft., a bosh dia. of 30 ft., and is equipped with 18 tuyeres.

In the first six months that the air-conditioning equipment was in operation, states Mr. Miller, from April to September inclusive, it definitely demonstrated that there is much to be gained by eliminating the high and widely fluctuating humidity in the blast air.

The operation of this furnace was noticeably smoother and more uniform than the other four blast furnaces which are not equipped with air conditioning and, of course, this was confirmed by an attractive improvement in iron production and coke consumption.

From Table I it will be noted that the conditioned air for the month of June was 3.351 grains; July, 3.642 grains; August, 3.499 grains; and September, 3.251 grains. In all cases it was over 3 grains, due to the fact that when the pre-compression chilled water system was installed only one compressor on which they guaranteed only 4 grains for June; 5 for July; 4 for August; 4 for September; and 4 for October was used. For the rest of the months of the year they guaranteed 3 grains.

Improvement in Furnace Operation

The author has found from experience to date that the furnace has operated more smoothly, drives more regularly, keeps a more constant pressure, more uniform heat, and a more uniform burden which, in turn, gives a more uniform temperature of iron and a more uniform analysis for the steel-making units.

Although there was no doubt in the minds of the operating men that air-conditioning equipment had effected a substantial improvement in the performance of No. 1 furnace, it was decided, in order to obtain more conclusive data, to transfer the conditioned air to another furnace of the same size. Accordingly, the conditioned air was transferred from No. 1 to No. 3 furnace during the first half of September and again put back on No. 1 furnace during the second half of the month. Immediately after switching conditioned air from No. 1 to No. 3, the production of No. 1 dropped off and the production of No. 3 increased correspondingly; that is, No. 1 decreased 141 net tons or 14.5 per cent. for the 13-day period, while No. 3 increased 134 net tons or 13.9 per cent. For the second half of the month, the conditioned air was switched back to No. 1 furnace, and it immediately recovered the production lost and the production of No. 3 furnace decreased correspondingly.

There are no delays involved in conditioning the blast air; the only delays experienced are those which ordinarily occur in operation without air conditioning. For the first six months the amount of steam saved on the turbo-blower in blowing No. 1 furnace on air-conditioning saved the equivalent of 2,900,000 kw.-hrs. This, in turn, more than offset the operating cost of the air-conditioning unit, after taking into account the loss of heat in the air entering the stoves which was at a lower temperature.

Table I.—*Comparative Data with and without Blast Conditioning.*

Period		Improvement with air-conditioning equipment		Humidity for specified months of 1941			
				Grains per cub. ft. of air			
				Natural air			Conditioned air
Without air conditioning	With air conditioning	Per cent. increase in iron production	Per cent. reduction in coke consumption	Minimum	Maximum	Average	
Monthly average for year 1940	April 1941 to September 1941, incl.	8.22	3.03	1.355	9.962	5.087	3.298
1940—	1941—						
June	June	14.55	4.31	2.746	9.066	5.666	3.351
July	July	16.67	5.46	3.064	9.962	6.702	3.642
August	August	14.84	3.04	3.064	8.782	5.757	3.499
September	September	18.46	0.25*	2.849	9.655	5.398	3.251
June to September, incl.	June to September, incl.	16.07	4.26*	—	—	—	—

* September, 1941, coke was not representative during the test period on air conditioning; consequently, the reduction of 4.26 per cent. indicated above was based on June to August, 1941, *versus* comparable months in 1940.

While the average increase in iron production was 16 per cent. during the summer months, June to September, inclusive, on the one furnace equipped with a pre-compression chilled water system at the Aliquippa Works, it is expected that when including winter months, the average increase in production throughout the year will be not less than 8 per cent. A reduction in coke rate can also be claimed, which is approximately 4 per cent.

There are some people in the steel industry, concludes the author, who do not think that one can gain on a 3-grain system, and that it is necessary to go down to 1 grain of moisture to get any real results. From the author's experience to date, having six months' actual operation on one blast furnace, it would appear that a greater percentage of the maximum tonnage that can be expected, will be produced from a 3-grain system.

A Ministry of Fuel

FORMULATION OF REQUIREMENTS FIRST

The recent proposal to set up a Ministry of Fuel in the country was referred to in an address by Dr. E. W. Smith, C.B.E., at a meeting of the Fuel Luncheon Club in London.

The speaker, giving his own conception of a Ministry of Fuel or its equivalent, said that perhaps it was wrong to describe it as a "Ministry." There should be an entity of a very high order, close up to the Cabinet, to advise the Government, and it should consist of independent people who had no axes to grind. No vested interests should be connected with it, but its personnel should be highly trained, and should make a thorough study of the whole fuel requirements of the country. Dr. Smith emphasised his reference to the country's "fuel requirements," because he did not believe that the success of the coal-mining industry depended on how much coal was raised; he believed that the success of that industry was reflected by the way in which coal was used. The body he had in mind would study how best the country's fuel requirements could be met from the resources available, and from an independent point of view; it would have such a status that it would be able to advise the highest authority, *i.e.*, the Cabinet, on fuel policy. That was not being done to-day; but it should be done. It was most important that we should not create a Ministry of Fuel or equivalent body until we had a definite idea of what we wanted it to do. But it must be an independent body which would not consider as one of its duties the bolstering up of any one of the sections of the fuel industries.

Continuing, the speaker said that our position to-day was not so good as it was years ago. Coal had become dearer, due to increased mining difficulties, higher costs, competition with oil and with other products of other countries. Thus, the position demanded immediate study. In considering the whole problem, it was wrong to start with methods of stimulating the consumption of coal. They must start at the other end, and assess their heat and power requirements domestically and industrially. They should determine which forms of fuel were best for particular purposes—though not necessarily the cheapest—and how those forms of fuel should be used; then they should consider, in the case of coal, for example, the purpose for which each type of coal should be used, how coals should be blended, and so on.

Fundamental Research

Coming to the question of research, the speaker said that the whole development of the future depended upon it, and in the first instance upon fundamental research. The surface of the problem of research into coal and heat, in industrial heating furnaces, and so on, had hardly been scratched; it was only in recent times that we had started to discuss how coke could best be used, and we were just beginning to know something about it. In that connection, Dr. Smith asked, should we continue much longer with separate and competitive research organisations? He congratulated the coal-owners on what he understood they were proposing to do in extending their research programme. He believed that the work of the British Coal Utilisation Research Association, representing the coal industry, should be co-ordinated with that of the Gas Research Board, the coke research organisations connected with the coking industry, and the fuel research of the iron and steel industry, and should be housed and controlled and directed in one of the most comprehensive research organisations ever conceived. That could be done. The electrical industry was already supporting the work of the British Coal Utilisation Research Association. Why should not all the research work on fuel be co-ordinated in one organisation?

One of the difficulties about research to-day was that a research man was appointed at a salary of about £700 a year to conduct research at some lonely place, perhaps at a university, and about 75 per cent. of his time was spent in rigging up apparatus, doing a little glass blowing and analytical work required by his researches. If the research work were properly organised, he could devote his time to thinking and directing; the analytical work and odds and ends, which any schoolboy delighted to do, would be done for him in the

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(*Continued from last column.*)

service departments belonging to the research organisation. There would also be common workshops. Dr. Smith added that he would like to see acres of research facilities for fuel, something even bigger than had been tackled by the General Electric Company, which in itself was something to aim at. In the sort of organisation he had in mind, one director could take charge of the research on matters peculiar to coal and the other solid fuels, another would be concerned with research into gas problems, and so on. At the same time, the research conducted by such an organisation should be isolated from the routine requirements of any particular industry. The research must be of the fundamental kind, the results forming a basis on which any unit in the fuel industries could develop.

Magnesium Dust Extraction

It should no longer be necessary to emphasise that the risk of explosion with magnesium dust is not greater than with the dust of most other metals. Not only have scores of tons of commercial magnesium powder been produced without serious accident, but large-scale grinding operations in this and other countries are undertaken daily without undue risk. Certain precautions are, however, necessary, and in their absence explosions are likely to occur.

Some of these precautions are not the less important for being obvious. Magnesium dust ranges in size from finest powder to $\frac{1}{32}$ in., and its lower explosive limit is approximately 70 mg. per cub. ft. Experience shows that, whereas the first explosion may be relatively harmless, the dust raised thereby will tend greatly to increase the quantities of dangerous dust and air mix-

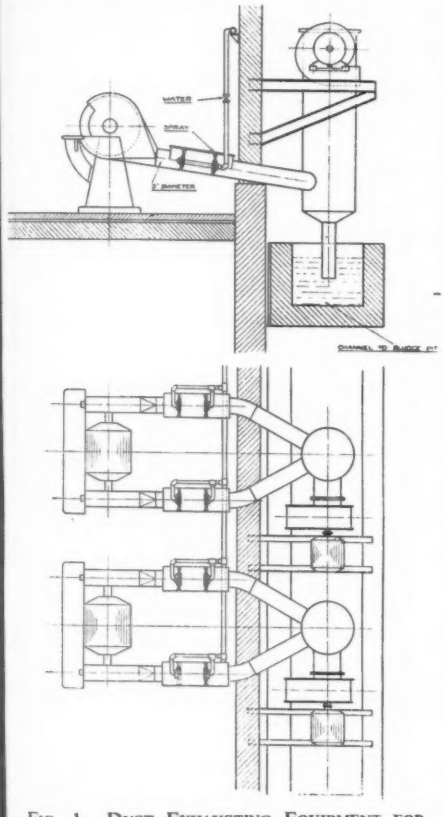

FIG. 1.—DUST EXHAUSTING EQUIPMENT FOR MAGNESIUM DUST.

ture and so cause a second and more serious explosion. Hence the need for scrupulous cleanliness and good ventilation in the workshop, which should also be dry. The walls must be smooth and devoid of all ledges where dust might accumulate. If pipes, shelves and corners difficult of access cannot be avoided, they must be swept regularly, vacuum cleaners not being used for this purpose. The sweepings should be placed in steel bins and removed from the premises. Floors adjacent to machines should be smooth and devoid of open cracks. Every source of ignition, including smoking, must be forbidden.

It is recommended that the clothing of operators, in addition to being made of a texture to which dust will not adhere, should be impregnated with a special fireproofing mixture. A "Faspos" No. 3 solution, obtainable from Imperial Chemical Industries, Limited, has been found effective for this purpose.

However, apart from these general precautions, further measures involving the use of special dust extraction plant are necessary to keep the dust out of the room atmosphere. The main feature of all such equipment, which in general resembles that used with other metals, is the drenching of the magnesium dust as close as possible to the point where it is produced—usually the grinding point. It should be noted in passing that, although this method of precipitation is the safest and easiest, it is not the sole method, and that in at least one process magnesium dust is exhausted without the use of water in large-scale powder production—a further proof that it is not exceptionally explosive.

Dust Settling Equipment

The type of equipment most widely recommended, and one which has already been installed in principle at most of the works handling magnesium, is illustrated in Fig. 1. According to this method, the dust is exhausted at the grinding point, close behind which it is sprayed with water from two nozzles, the action of the nozzles being visible through a transparent non-inflammable resin cover. The air, dust and water mixture is conveyed through a pipe to the separator outside the building, where the dust and water descend to the sludge pit, which they enter below the water level. This pit is divided by baffles so as to permit the dust to settle in one portion, while the dust-free water overflows the baffles into another division, from which it escapes through an outflow. The fan, driven by a flameproof motor, is installed on the separator, which is a plain pipe of sufficient cross-sectional area to ensure that the water, owing to reduced air speed, will fall out of suspension and descend to the pit while only the air will be drawn through the fan. The controls of the exhaust equipment are so correlated with the grinding machine that the motor of the latter cannot work until fan and water spray are operating, and will stop if for any reason the exhaust suction should cease. All pipes must have smooth walls. The air flow at the grinding point should be not less than 100 ft. per sec., with a pipe diameter of 5 in. at the exhaust hood for ordinary-type grinding heads. The distance which the dust has to travel between grinding point and sludge pit must be kept to a minimum.

While it is preferable and recommended that each machine (with one or two grinding discs) should be fitted with an independent dust exhaust and a fan driven by its own motor, it is possible to arrange for several machines to be exhausted, either through a common separator or through two or more separators connected by duct to a common fan, the air, dust and water mixture being conveyed in every case by the shortest route. In such a case, however, it is necessary to fit control gear that automatically stops all grinding machines if the exhaust fails from any cause. There are other ways of exhausting dust, and the method ultimately chosen will depend upon such factors as floor space, water supply, climate and special requirements.

The sludge must be periodically removed from the pit and be destroyed by burning in an open space or in a suitable brick-lined stove, the usual precautions being taken. It can also be diluted by mixing with a five-fold volume of sand, and then buried; or it can be conveyed to the waste tip and covered with coarse salt. Owing to the inflammability of any dust that may be retained in the hoods, as well as of the hydrogen developed by the sludge, no smoking should be permitted near this plant.

This information is contained in a pamphlet issued by F. A. Hughes & Company, Limited, Abbey House, Baker Street, London, N.W.1. Additionally, a number of other methods are detailed and criticised. The pamphlet is available to our readers on writing to Abbey House.

The New Patents and Designs Act

The Patents and Designs Act, 1942, makes important alterations in the law governing patents. Protection is normally given under a patent for sixteen years (that is with the necessary renewal fees paid), but an extension can now be obtained, by "petition" to the High Court if the court considers that the patentee has been inadequately rewarded by his patent. In considering an application under this rule regard must be had to the nature and merits of the patent in relation to the public, to the profits of the patentee as such, and all the circumstances of the case.

By another provision an extension can be applied for, where the patentee as such has suffered loss or damage, by reason of this country being at war, or loss of opportunity of dealing in or developing the patent owing to the patentee being engaged in work of national importance in connection with the war. Ordinarily an extension can only be given for five years, or ten years in exceptional cases, or alternatively a new patent may be granted with such restrictions, conditions, and provisions considered necessary by the court; an application must be made at least six months before the time when the patent is due to expire, although the court may permit a later application as long as it is not later than the actual expiration date.

Patent law is different to the law of other statutes, in that it is really international in its application, in so much that if a patent is protected in any one country and that country is a member of the International Convention, the same protection is given in every other Convention country, if of course proper steps are taken according to the law of the particular country concerned. Time naturally is an essential factor in patent law, and as regards this country, where an application has been made in another Convention country, priority as regards the patent or design is given here in front of any other application, but the application must be made within twelve months after the date of application (designs: six months) in the Convention country concerned. This 1942 measure now gives power to the Board of Trade to extend this period of grace, where the applicant has been prevented by the law of the particular country or by Government action from making application in the time ordinarily allowed, that is if the other country has made or makes a similar provision.

Normally the Government can use any patent on agreed terms, but cannot sell any patented articles arising from such right, unless they are no longer required for the services of the State. Now, by this Act, really to cover imports of patented goods by Government departments (*e.g.*, food, certain raw materials) power is given to sell any patented article without taking into account the proviso which ordinarily applies as shown.

Cathodic Protection of Pipe Lines

The use of an external current applied cathodically for protecting pipe lines against corrosion was first undertaken some 30 years ago. Since that time this system of protection has been widely extended, especially within the last 10 years. According to a recent estimate, 750 cathodic protection units, protecting 3,000 miles of line, are in operation in the United States. Because of the practical importance of cathodic protection, Mr. K. H. Logan, of the Bureau of Standards underground corrosion section, held a number of conferences with pipe-line operators and corrosion engineers during 1941. These all indicated that cathodic protection is both practical and economical for the protection of transmission pipe lines. It has even proved successful in protecting distribution systems in the few cities in which the method has been tried. Because of interlacing networks, the difficulties in protecting distribution systems are, of course, much greater. Such failures in the operation of cathodic protection as have been reported are to be attributed to poor design and poor maintenance, and since similar failures are to be expected in any pioneering undertaking, they are not to be taken too seriously. One of the major unsolved problems in cathodic protection is the measurement of the minimum current density required for protection. Otherwise, it is difficult to determine, except by experience, whether a pipe line is over or under protected.

Organisation of Production

ALLOCATION OF LABOUR

The machinery for organising labour supply is severely criticised by the Select Committee on National Expenditure in their Seventh Report of the present session of Parliament, published by the Stationery Office. The Committee consider that the organisation of labour supply has not been undertaken "with that breadth of conception and firmness of execution which are necessary for the creation of the maximum military strength of which the country is capable." They have also come to the conclusion that the key to the full deployment of our industrial strength lies in improvement of the present Departmental organisation.

In their Eighth Report, also published last week, the Committee comment on the efficiency of the methods developed by the Iron and Steel Control.

The broad conclusion at which the Committee arrive as the result of their investigation into the machinery for organising labour supply is that no more has been attempted than piecemeal and *ad hoc* adjustments of pre-war methods of organisation. The distribution of man-power between industry and the Services has been determined, not by close estimation of needs and thorough survey of industrial capacity, but by the demands of the Fighting Services and rough estimates of the numbers required by industry as at present organised. The reorganisation of the non-munitions industries, which should have accompanied the withdrawal of men to the Services and the limitation of supplies, was long delayed; and concentration of non-essential undertakings, while in some cases overdone to the point of endangering minimum domestic supplies, is in others still limited both in scope and in thoroughness. The training of workpeople has not been organised with a view to the maximum expansion of industry, has been allowed to wait upon the arrival of volunteers for training, and has succeeded only in meeting some of the more urgent demands for semi-skilled labour.

Competition for Workers

Although the Essential Work Orders prevent an employer from enticing labour away from another firm, the initiative in obtaining labour remains with the employer, and in that sense competition between employers still goes on. There is, moreover, competition between Departments.

The Committee recommend that a permanent committee, independent of Departments and reporting direct to the War Cabinet, should be set up to estimate the best allocation of man-power between industry and the Fighting Services, and to examine the allocation of man-power between the broad categories of industries.

Dealing with the organisation of production in their Eighth Report, the Select Committee state that there must be a programme at all times planned sufficiently far ahead to enable a proper flow of manufacturing processes to be organised. There should be decentralisation by the Supply Departments for arranging and supervising the details of production. Methods for the grouping of manufacturers, either on a geographical or a functional basis, should be examined with the objects both of reducing the number of points of contact between the Supply Departments and industry, and also of allowing industry to take a greater share of the work of settling how to deliver the goods required by the Supply Department. The suggestion should be considered that each important industry or industrial group should have a liaison officer to work with the main Supply Departments.

Iron and Steel Control

The Committee consider that some of the methods adopted by the Iron and Steel Control for ensuring contacts with particular branches of industry and for distributing orders among individual firms on a rationalised basis might be capable of wider adoption. The organisation of this Control is of special interest because, in effect, it represents the transformation of what in peace was an industrial association into an instrument for carrying out Government purposes during war. It must, of course, be recognised that this industrial organisation had been in existence several years before the war, and had been able to build up the best integration of industry in the country; and, further, that the iron and steel industry is of a

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Wholesale Price Changes in 1939-1941

The January number of the League of Nations Monthly Bulletin of Statistics, which has just been issued in Geneva, contains special studies on the movement of prices in most countries from the beginning of the war up to the end of December, 1941. In the chief overseas countries producing raw materials for which data are available, the rise in wholesale prices which, until the beginning of 1941, had been moderate, suddenly accelerated. The United States index, which, in February, 1941, was only 5 per cent. above its average level during the first half of 1939, was 23 per cent. above that level in December. At that date the prices of certain raw materials for which no maximum had been fixed, had more than doubled as compared with the beginning of the year. Some percentage increases between December, 1940, and December, 1941 were:—Cotton, 75; cottonseed oil, 125; motor spirit, 85; wheat, 50; maize, 35; lard, 125; cocoa, 60; and coffee, 75 per cent.

From January to October, 1941, wholesale price indices (January to June, 1939 = 100) had gone up from 102 to 115 in Mexico, from 115 to 150 in Chile, from 120 to 160 in Argentine; the index for Peru rose from 125 to 160 between January and December. In India, the index went up from 120 in January, 1941, to 150 in October; in the Netherlands Indies, from 125 in January to 157 in September. In New Zealand, on the other hand, the increase during 1941 seems to have been small. In September, although it reached 25 per cent. as compared with pre-war, it was only 4 per cent. as compared with January, 1941. In Australia, the latest available figures point to a rise of less than 12 per cent. in June, 1941, by comparison with the first half of 1939. In Europe, the rise in wholesale prices continued in 1941. Whereas in some countries, such as Denmark, Norway, Sweden and the United Kingdom, the rate of increase slowed down, in others it remained constant (Spain, Rumania, Switzerland) or accelerated (Bulgaria, Hungary).

The movement of the cost of living follows that of wholesale prices, but with a greater or smaller lag. It should be remembered that cost-of-living indices reflect variations in the cost of maintaining a given, unchanging, standard of consumption, as compared with some pre-war base period. They do not indicate changes in actual expenditure, since no account is taken of rationing of essential goods, the disappearance or shortage of certain articles, the introduction of substitutes or changes in the quality of products. Within one country, the rise varies greatly as between different groups of expenditure. Whilst rents have everywhere remained stable, the widest fluctuations occurred in regard to foodstuffs, heating or clothing.

South African Iron and Steel

A Bill providing for a £6,500,000 increase in the share capital of the South African Iron & Steel Industrial Corporation, Limited, was before the South African House of Assembly last week. Mr. R. Stuttaford, Minister of Commerce and Industries, said that he did not know how the war effort would have been carried on without the Corporation, whose capacity, originally set at 180,000 tons of raw steel a year, would soon be increased to 420,000 tons. Additional machinery to be acquired would be assigned to the production of war materials as the first essential. Provision was also being made for the mining of increased supplies of ore and for the manufacture of wire of various types which was urgently needed by farmers and was difficult to obtain elsewhere. Attention was also being given to the manufacture of farm implements and machinery.

Wiring of Foundries

A large foundry concern, having decided to rewire its shops, asks the pertinent question as to whether, in view of the strenuous conditions encountered, any recommendations or specifications exist as to the best class of wiring or wiring protection to withstand such conditions. To the best of our knowledge, this is a phase of activity which has been entirely neglected by both the standardising authorities and the technical institutes of the world. The initial snag is that foundries are not so unified either in construction or method of working as to afford a good basis for consideration from this angle, but with the expansion of the desulphurisation process it is worthy of consideration.

Patent Specifications Accepted

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.

543,657 United Steel Companies, Limited, and Russell, G. A. V. Rolling mills.

543,726 High Duty Alloys, Limited, and Whitby, L. Protection of magnesium and magnesium base alloys.

543,760 Arimori, T., Konishi, Y., Ishibashi, J., and Yoshimura, R. Method of manufacturing metallic magnesium.

543,769 Castings Patent Corporation. Making of moulds from mixtures of powdered material and liquids, and particularly gypsum base moulds for casting metals.

543,770 Pyrene Company, Limited, Clifford, W. J., and Adams, H. H. Cleaning of metal or other surfaces.

543,796 Spenle, C. D. Nozzles used for sand-blasting purposes.

543,810 Glacier Metal Company, Limited, and Bonifas, V. A. Method of and apparatus for casting bodies of metal with cored holes.

543,833 Hanson van Winkle-Munning Company. Electrodeposition of nickel.

543,834 Rausser, E. Process for the production of nickel coatings on articles of aluminium or aluminium alloys.

543,835 Stewarts and Lloyds, Limited, and Hendry, D. C. Apparatus for sintering ores and like materials.

543,856 Dewey & Almy Chemical Company. Soldering, tinning, and galvanising fluxes.

543,867 Brown & Sons (Huddersfield), Limited, and Jackson, J. F. B. Centrifugal casting machines.

Clothing Coupons for Industrial Workers

The Board of Trade have decided to award supplementary clothing coupons to certain types of industrial workers who have not yet received extra coupons. Coupons will be issued to certain workers in ferrous wire and rod rolling, ferrous and non-ferrous moulding, the cutlery trades, and in certain occupations common to all sections of the metal trades; coal trimming and stoking of hand-fired boilers; and outside steel constructional work. Employers of workers in these trades should make application to their nearest Local Office of the Ministry of Labour and National Service between Monday, April 13, and Saturday, April 25. The exact types of workers eligible for supplementary coupons are listed in a booklet entitled "Third Award of Industrial Supplementary Clothing Coupons," obtainable by employers during that period from Local Offices.

American Ferrochrome

American manufacturers of ferrochromium have voluntarily agreed to changes in specifications, which will permit the use of lower grade chrome ores and conservation of higher grades, states the Office of Production Management. Present ferrochrome specifications of 68 to 69 per cent. chromium, 4 to 6 per cent. carbon and 1 to 2 per cent. silicon will be changed to 60 to 63 per cent. chromium, 6 to 8 per cent. carbon, and 4 to 6 per cent. silicon by the agreement. The agreement affects the type of ferrochromium used in making engineering steels running up to about 3 per cent. chromium, and does not affect stainless steel and heat-resistant alloy steels in which a larger amount of chromium is used. The new specifications are a return to those in common use 20 years ago, and are approximately the same as the ones in use during World War 1. Conservation of chromium is a result of Japanese aggression in the Pacific.

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nature which made it specially suitable for this development. Nevertheless, it has been found possible during the war to extend the scope of the pre-war organisation in several directions; and the Committee believe that there are at least possibilities of developments on similar lines in the case of other industries. Wartime conditions should make this easier rather than the reverse.

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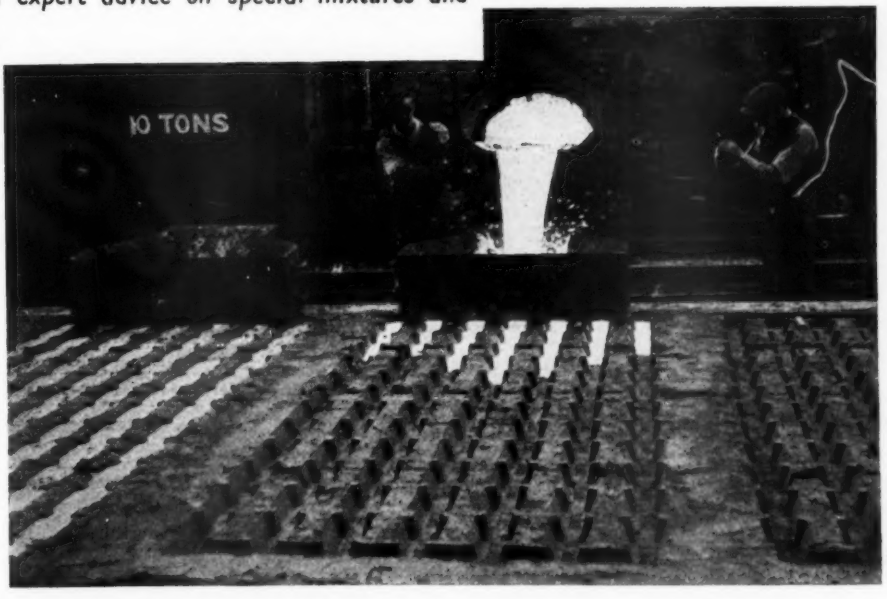

THE STANTON IRONWORKS COMPANY LIMITED, NEAR NOTTINGHAM

The Week's News in Brief

Trade Talk

TO SECURE further economies in the use of zinc, the Non-ferrous Metal Control has imposed a ban on the galvanising of various articles of hollow-ware.

A COMMISSION to consider the problems of the building industry after the war is to be set up by the National Federation of Building Trades Employers.

THE FIRM of John Bedford & Sons, Limited, crucible steel makers, Lion Works, Mowbray Street, Sheffield, celebrates this year the 150th anniversary of its foundation in 1792.

THE NATIONAL SCREW AND WIRE PRODUCTS FACTORY, the first to make screws successfully in India, was opened at the end of November, by the Director-General of Munitions Production.

THE AMERICAN STEEL CASTINGS industry last year attained a production only once exceeded, and that in 1929, when 1,353,000 short tons were made. In 1940 the output was of the order of 1,300,000 tons.

DESPITE A SHORTAGE in shipping space, iron-ore exports from Chile to the United States during the first 9 months of 1941 were 1,226,106 tons, as against 1,246,339 tons in the parallel period of 1940.

AT THE ANNUAL MEETING of the Manchester Engineers' Club Mr. A. B. Mallinson was re-elected president for the second year and Mr. E. Royle and Mr. A. G. Livesay were re-elected honorary treasurer and honorary secretary respectively.

THE Burntisland Shipbuilding Company, Limited, has acquired the total share capital of Hall, Russell & Company, Limited, shipbuilders and engineers, Aberdeen. The interests and activities of the two companies will be under the control of the Burntisland Shipbuilding Company, of which Mr. Wilfrid Ayre is chairman and managing director. Mr. A. Hall Wilson, who has been associated with Hall, Russell & Company over a long period of years, will continue to act as chairman of the Aberdeen company. He will become a member of the board of the Burntisland Shipbuilding Company.

AS PART of the general plan to encourage the use of part-time workers to the maximum extent possible, the Minister of Labour and National Service has consulted with both sides of industry about the payment of unemployment insurance contributions in respect of part-time workers. As a result he has made a regulation under which, as from April 13, employers and workers will be relieved from unemployment insurance contributions in the case of employment begun on or after September 3, 1939, where the employment does not involve more than 30 hours' work in any week and the services rendered are such as, in the Minister's opinion, are not ordinarily performed, or would not, but for circumstances arising out of the war, ordinarily be performed, by persons rendering not more than 30 hours' service weekly. The new rule does not apply to contributions in respect of Health and Pensions insurance. Part-time workers excepted from unemployment insurance by the new regulation will also be excluded from the operation of the Essential Work Orders.

Obituary

MR. STEPHEN CROWTHER died suddenly last week. He was a partner in the firm of Crowther & Gee, engineers and brassfounders, Huddersfield.

CAPT. J. E. MILLS, J.P., chairman of John Mills & Company (Llanidloes), Limited, mining machinery manufacturers, died recently. Capt. Mills was a member of the Welsh Regional Board of the Ministry of Production.

MR. SAMUEL BARBOUR WILSON, director and secretary of Glenfield & Kennedy, Limited, engineers, died at Kilmarnock on April 6, aged 68. He joined Glenfield & Kennedy when he was 14. Appointed assistant secretary in 1909, he became secretary in 1913, and was made a director in 1935.

MR. ROBERT CLARK has died at Falkirk, aged 76. Previous to his retirement in 1938 he had been for 57½ years with Falkirk Iron Company, Limited, being foreman in the moulding department. He was a founder member of the Central Ironmoulders' Association (now the Ironfounding Workers' Association), and was the second chairman of that organisation for five years.

Personal

LORD DUDLEY GORDON has been elected president of the Federation of British Industries for the third successive year.

SIR GEORGE BEHARRELL has been appointed Director-General of Controls in the Ministry of Supply. He will supervise generally the administration of the controls.

DR. F. W. LANCHESTER, F.R.S., has been awarded the James Alfred Ewing Medal for 1941, on the joint recommendation of the presidents of the Royal Society and the Institution of Civil Engineers.

MR. EDGAR G. REES, of Llanelly, liaison officer under the Ministry of Supply, was re-elected president of the South Wales and Monmouthshire Iron and Steel Scrap Merchants' Association at the 24th annual meeting.

MR. N. G. CALDER, who has resigned from Thomas E. Gray & Company, Limited, was sales manager of the stove department and not chief engineer, as stated in our issue of March 26. MR. J. CLULOW is the company's chief engineer and has been in that post for some years past.

Wills

MARSHALL, S. S., director of Samuel Staniforth, Limited, cutlery forgers, Sheffield	£10,117
RAWLINGS, GEORGE, managing director of the Neville Foundry Company, Limited, Rotherham	£5,103
BUTLER, H., of Halifax, chairman and managing director of the Butler Machine Tool Company, Limited	£71,735
ELTRINGHAM, HARRY, D.Sc., F.R.S., of Stroud, Glos., formerly partner in Joseph T. Eltringham & Company, shipbuilders	£70,940

Reports and Dividends

(Figures in brackets refer to the previous financial year.)

Sanbra—Dividend of 7½% on the ordinary shares (nil).

A. Reyrolle—Final dividend of 7½%, making 12½% (same).

James H. Lamont—Final dividend of 15% (20%), making 22½% (25%).

Indian Iron & Steel Company—Interim dividend of 7½%, free of Indian tax (same).

Trussed Concrete Steel—Profit for 1941, £1,615 (£20,347); dividend of 2½% (7½%).

Halesowen Steel—Final dividend on the ordinary shares of 17½% (same), making 25% (same).

Lancashire Steel Corporation—Half-yearly dividend on the 5% cumulative redeemable first preference shares.

Short Bros. (Rochester & Bedford)—Trading profit to August 31 last, £88,340 (£183,793); royalties, commissions and rents, £109,848 (£69,907); dividend of 25% (27½%); forward, £39,644 (£38,285).

Drakes—Trading profit for 1941, including dividends and interest, etc., £22,589 (£18,455); net profit, £7,450 (£10,053); special depreciation, £2,500; dividend on the 6% cumulative preference shares for the three years ended December 31, 1941, £7,200; forward, £13,757 (£16,007).

Engineers & Ironfounders—Net profit for 1941, £6,854 (£6,667); dividend, gross, on the 7% cumulative preference shares, £1,805; interim dividend of 2½%, less tax, on the ordinary shares (same), £322; final dividend of 7½% (same), £967; bonus of 1s. a share (same), £645; to general reserve, £7,977; forward, £7,418 (£12,280).

Sir Wm. Arrol & Company—Trading profit for 1941, £190,627; depreciation, £16,000 (£12,000); war damage insurance, £4,855 (nil); A.R.P., £9,931 (£11,340); taxation, £105,000 (same); net profit, £54,591 (£56,135); 7% preference dividend, £13,921 (£16,555); distribution of 25% (same) on the ordinary shares (dividend of 15% and bonus of 2s. per share), £14,835 (£17,060); general reserve, £25,000 (£20,000); forward, £46,635 (£45,800).

Bruntons (Musselburgh)—Trading profit for 1941, after depreciation, A.R.P. and tax, £40,258 (£49,433); interest, etc., £4,898 (£4,597); staff pensions and fees, £1,974; war risk insurance and war damage contribution, £6,360 (nil); net profit, £36,822 (£52,094); plus tax adjustment on ordinary dividend paid April, 1941, £3,750; 6% preference dividend, £7,500 (£8,625); ordinary dividend of 20% (same), £25,000 (£28,750); additional tax under Finance Act, 1941, £9,000 (nil); forward, £16,766 (£17,694 after £10,000 to reserve).

New Companies

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

J. J. Henry & Company, Rosebank Wharf, Lysia Street, Fulham, London, S.W.6—Engineers, boiler makers, founders, etc. £1,000. C. A. Fisher and O. T. Hill.

Guest Keen Baldwins Iron & Steel—Profit for 1941, after tax, £676,949 (£602,501); depreciation, £400,000 (same); net balance after debenture interest and redemption, £124,568 (£52,098); ordinary dividend of 5% (nil).

Eclipse Foundry Company (Leicester)—To take over the business carried on by William Spiers, Limited (in voluntary liquidation). T. A. Spiers, 50, Chandos Road, Newbury, Berks; E. Spiers, W. A. Saunderson, and D. V. Paine.

Higher Prices for High-Speed Steel Scrap

The Minister of Supply has issued the Control of Iron and Steel (No. 21) (Scrap) Order, 1942, which came into force on April 10. It amends the No. 14 (Scrap) Order by increasing the prices of high-speed steel scrap and magnet steel scrap containing tungsten in proportion to the recent increases in the price of high-speed steel containing tungsten. The new prices are as follow:—

High-speed solid steel scrap containing 14 per cent. to 22 per cent. tungsten, 1s. 5d. per lb. (against 1s. previously).

High-speed steel turnings containing 14 per cent. to 22 per cent. tungsten, 10d. per lb. (against 7d.).

Magnet steel scrap containing 5 per cent. to 6 per cent. tungsten, £42 10s. per ton (£30).

In addition, maximum prices for scrap carbon steel for use in high-frequency electric and crucible furnaces have been included in the schedules of maximum prices attached to the No. 14 Order. This is a formal step and does not represent any change in prices, which are:—

Not exceeding 0.15 per cent. carbon and 0.03 per cent. sulphur and phosphorus, £7 10s. per ton.

Exceeding 0.15 per cent. C, but not 0.03 S and P, £7 5s. per ton.

Not exceeding 0.15 per cent. C and 0.5 per cent. S and P, £6 10s. per ton.

Exceeding 0.15 per cent. C but not exceeding 0.5 per cent. S and P, £6 5s. per ton.

Not exceeding 0.05 per cent. C, 0.03 S, 0.03 P, 0.05 Mn, and 0.1 Si, £9 per ton.

Applications for Trade Marks

The following applications to register trade marks appear in the "Trade Marks Journal":—

"NORAL"—Cast, forged, extruded, rolled or fabricated aluminium. NORTHERN ALUMINIUM COMPANY, LIMITED, Southam Road, Banbury, Oxon.

"EASTMORL"—Metal-working machinery, and machine tools. EAST LONDON ENGINEERING WORKS, LIMITED, 76, Cobden Road, Leytonstone, London, E.11.

"K.S.B."—Centrifugal pumps, submersible electric motors, etc. K.S.B. MANUFACTURING COMPANY, LIMITED, 6, Broad Street Place, London, E.C.2.

"THERMALOX"—Refractory oxides of metals and of silicon and boron. THERMAL SYNDICATE, LIMITED, Vitreosil Works, Neptune Bank, Wallsend, Northumberland.

"STANCROFT"—Castings, girders, metal ropes, anchor plates, structural iron and steel work, etc. STANLEY CROFT, LIMITED, 48, Lancaster Street, Birmingham, 4.

"LUTO"—Rotary, centrifugal, reciprocating and diaphragm pumps. SIGMUND PUMPS (GREAT BRITAIN), LIMITED, Team Valley Estate, Gateshead, 11, Co. Durham.

"STANCROFT"—Power transmission gear, ball bearings, machine punches, pulleys, metal shearing machines, lathes, sheet metal working machinery, etc. STANLEY CROFT, LIMITED, 48, Lancaster Street, Birmingham, 4.

"ENKOL"—Common metals and alloys; structural iron and steelwork; chains; rails; fishplates; pipes and tubes; bunkers, etc. ERNEST NEWELL & COMPANY, LIMITED, Station Road, Misterton, Notts.

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Raw Material Markets

There have been some marked changes in the foundry industry since the beginning of the war. Prior to the outbreak of hostilities demand for heavy and light castings was fairly evenly balanced, but wartime conditions have brought about a large expansion in the call for heavy products, while demand for light castings has fallen off and is now very quiet. A substantial volume of heavy castings is needed for Government orders, but there is little or no demand from official departments for the light descriptions, and normal outlets, both to home and overseas destinations, have been sacrificed to a large extent because of the need to conserve materials for the war machine. Supplies of raw materials have also been affected by wartime conditions; ample quantities of home-produced high-phosphorus iron are available, but imports of foreign ores have had to be curtailed, so that production of the better qualities of iron has suffered appreciably. Foundrymen have, therefore, had to alter their mixtures where possible, and are now incorporating supplies of high-phosphorus and refined irons, together with a fair proportion of steel scrap.

Pig-Iron

MIDDLESBROUGH—Engineering castings are in strong demand and the various Government departments are pressing for regular contract deliveries. Manufacturers are operating to full capacity and, despite a certain amount of inconvenience due to shortage of materials, are producing gratifying outputs. Consumption of low-phosphorus iron and hematite has had to be drastically reduced, but satisfactory results are being gained by the use of alternative grades. Basic iron is being produced by most of the ironworks operating on the North-East Coast, consumers of high-phosphorus foundry material acquiring their needs from manufacturers in the Midlands. Licences for the latter grade of iron are comparatively easy to secure, but distribution of the better qualities is very carefully carried out. There are few makers of light castings in the Cleveland area able to report satisfactory conditions, and order-books, on the whole, are poorly filled.

LANCASHIRE—Producers of heavy castings are in the market for all the low-phosphorus iron they can secure; supplies are still on the short side and the deficiency has to be made good by the incorporation of other qualities in foundry mixtures. Consumption of iron in this section of the industry is at peak levels, but in other directions there is little activity. In the light-castings trade, for example, business is dull, while many jobbing foundrymen have little cause for satisfaction, only those works connected with speciality castings being kept in full employment. There is also not a lot doing at textile-machinery works, so that the demand for ordinary grades of foundry iron remains rather small.

MIDLANDS—Government requirements of heavy castings are such that there are few makers in this district who are not entirely given over to this type of work. Manufacturers are not getting all the special irons which they need, but further progress has been achieved in the use of high-phosphorus iron and other qualities in more plentiful supply for the production of heavy castings. Low-phosphorus iron and hematite are difficult to obtain, but, where their use is essential, supplies are promptly forthcoming under licences issued by the Control authorities. Refined pig-iron and steel scrap are being extensively used as alternatives to the better qualities of iron; supplies of the latter are fairly comfortable at the moment, but, looking ahead, it is obvious that deliveries will have to be enlarged. Cast-iron scrap has been rather more plentiful of late. The situation of the light-castings trade does not show any improvement, the majority of the works in this category being badly in need of further business, which, unfortunately, it does not appear will be forthcoming, as Government departments' requirements are meagre and other business outlets have been curtailed drastically since industry came on to a war footing.

SCOTLAND—Ordinary grades of foundry iron are fairly easy to obtain, but the tightness in low-phosphorus and hematite irons is unrelieved, and consumers are being compelled to take up larger quantities of high-phosphorus iron and other materials of which the supply is ampler. Heavy engineering foundries, including marine foundries, are in possession of full order-books, with every prospect of their being fully occupied with urgent Government work over a long period. Some makers of light castings are fairly well placed for work, but, on the whole, this section is quiet, and it cannot be said there is much likelihood of there being a substantial improvement, as Government orders are few and far between. Steelworks in this district are not getting all the hematite they ask for, but in other respects raw materials are coming forward satisfactorily.

Coke

There are indications that some consumers of foundry coke are paying increased attention to their reserves, which is only to be expected at this time of the year, when deliveries are usually promptly forthcoming. The ovens are now in a good position to deal with this extra business, having large stocks on hand.

Steel

Production of special and alloy grades of steel has been materially increased during the past few months, and since the beginning of this year outputs have been stepped up to a considerable degree. The peak has by no means been attained, and every opportunity is being taken to bring into operation new units of production. These grades are fully absorbed by the manufacturers of munitions, armaments, etc., whose demands appear to be insatiable. Boiler and tank plates are in continued strong demand, consumers having a large volume of Government specifications on their books. In fact, they rarely have an opportunity to take on any other type of work. Sheet makers are not so briskly employed, the curtailment of the manufacture of galvanised qualities having reduced the scale of activities in this branch. Demands on makers of crucible and electric steels are keen, but the works are able to send out adequate tonnages to satisfy current requirements. Small tools are in great demand and outputs have been brought up to a much higher level.

Scrap

The improved rate of deliveries of many qualities of iron and steel scrap has been maintained, but the position is still far from satisfactory, as consumption is ever increasing and the future outlook with regard to supplies is by no means happy. The maintenance of an adequate supply of scrap is of vital importance to the war effort, especially in connection with the production of steel, so that efforts to expand the collection of old metal cannot be relaxed. The heavier and better qualities are in greatest demand, supplies of some of the other sorts being in excess of consumption. Some ironfounders are not getting all the metal they have been granted licences for, and complaints on this account have recently been heard, while some users are having to make do with other grades than those to which they have been accustomed.

Metals

COPPER—According to reports from La Paz, the United States has arranged to buy up the whole of the copper output of Bolivia on the same basis as her purchases from Chile. The Metals Reserve Company is taking 1,800 tons from Bolivia's present stocks, and will buy 6,500 tons per annum in future. It is believed that in March the Metals Reserve Company allocated only about 15,000 tons of imported copper for delivery; domestic output in the same period was in the region of 85,000 tons, making the total supplies to consumers during the month some 100,000 tons, which was about the same as in February. Distribution of copper in the United States has been considerably tightened up of late, and recently only consumers with high-priority permits have been permitted to take up supplies. New brass mills will shortly be coming into operation, and will tax the copper supply still further. Stocks of copper held by American fabricators are believed to be much less than their outstanding orders, but the total of stocks of 291,515 short tons at the end of January is, it is suggested, larger than necessary. Probably the limitation of deliveries during February and March is partly designed to enforce a reduction of these stocks. It is reported that the American Defence Plant Corporation has proposals for expanding the annual capacity of the Phelps Dodge Morenci property, which has lately commenced operations on a plant capacity of 75,000 tons per annum.

The copper situation in this country may be considered to be fairly satisfactory, as all high-priority consumers are able to obtain adequate tonnages to enable them to carry on at full capacity. There is absolutely none to spare for non-essential purposes, however, as the Control authorities are maintaining a careful watch with a view to safeguarding future needs of the war machine.

TIN—There is little fresh to report as far as tin is concerned, and the main feature at the moment is the effort being made to curtail usage of the metal, which is necessary in view of the lost sources of production due to Japanese action in the Far East. The Non-Ferrous Metals Control has issued a pamphlet on the subject of economy in the use of tin plain bearings and bearing metals in which it is stressed that the required economy in tin can only be achieved speedily with the immediate co-operation of designers.

SPELTER—Consumption of spelter in connection with orders for war materials continues to mount, and it is necessary that the use of the metal in other directions be severely restricted, as supplies are by no means plentiful, although they are quite adequate for essential needs, and there is no reason to believe that this position will deteriorate if the present supervision is maintained over distribution.

LEAD—Until comparatively recently, supplies of lead were being freely licensed, but the Japanese threat to production in the East has brought about a new situation which demands that consumption for other than war purposes should be eliminated, or at least cut to the bone. There must be large stocks in the country, but that is no reason for any extravagant use of the metal. Certain sources of consumption of lead have dwindled considerably through war conditions, demand for lead pipes and sheets being a case in point, but lead is, nevertheless, playing quite a considerable part in the national effort.

State-Owned Ironworks in Sweden

The plans for the construction in northernmost Sweden of a Government-owned ironworks are advancing, and the Government have submitted to the Riksdag a proposal for additional finance for the purpose. A sum of ten million kronor was granted by the Riksdag when the decision to establish the ironworks was taken, and the Government proposal now presented asks for another seven millions for subscription for shares in the company founded for the purpose, the Norrbotten Järnverks Aktiebolag. An additional amount of three millions will be put at its disposal as working capital. Construction costs are estimated at 17 million kronor. A location near Lulea has been chosen. The furnaces will all be electrical, *viz.*, two electric blast furnaces for 60,000 tons of pig-iron per annum, and basic-Bessemer and electric-steel works for the refining of the pig-iron. A third electric blast furnace may be installed later. A supply of raw materials is assured, and also the supply of electric power will be good. Construction of the plant was started several months ago, and it is calculated that the whole plant will be completed early in 1943.

Antimony-Free Enamels

Vital defence materials are being released through the wide-spread adoption in the United States of antimony-free porcelain enamels, according to the Porcelain Enamel & Manufacturing Company, Baltimore. The company says that range, refrigerator and other manufacturers report they have reduced the amount of opacifier used from 3 to 1 per cent., that 15 per cent. less enamel is used, burning time is shortened, reducing the amount of fuel consumed, and that production has been increased without additional equipment.

Bakelite, Limited

The principal factory of Bakelite, Limited, is at Birmingham, and not at Manchester, as was indicated in our issue of April 2 in an article dealing with one of their products.

MAY 13 1942

FOUNDRY TRADE JOURNAL

EST. 1902

WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

VOL. 66. No. 1339. APRIL 16, 1942

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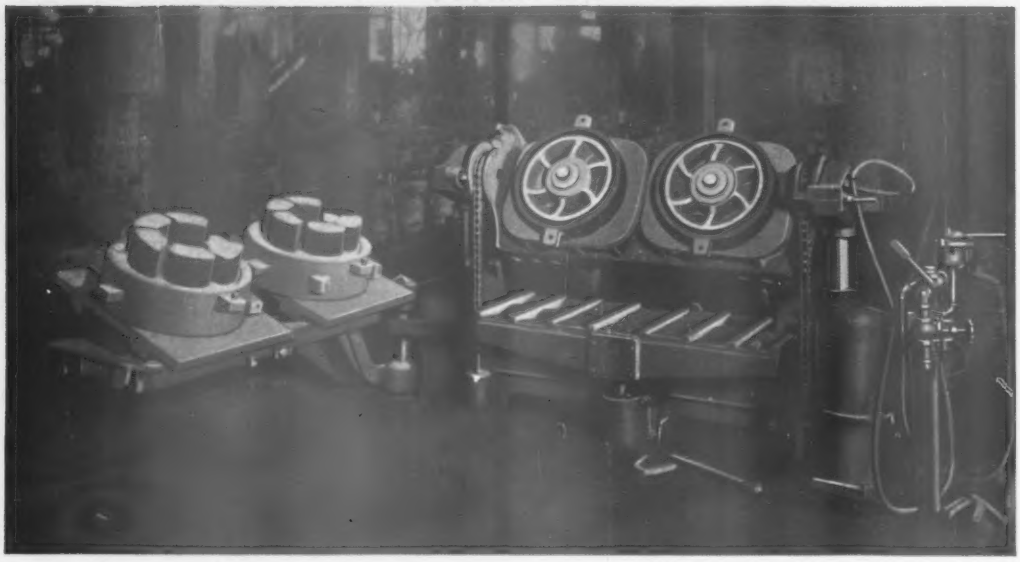

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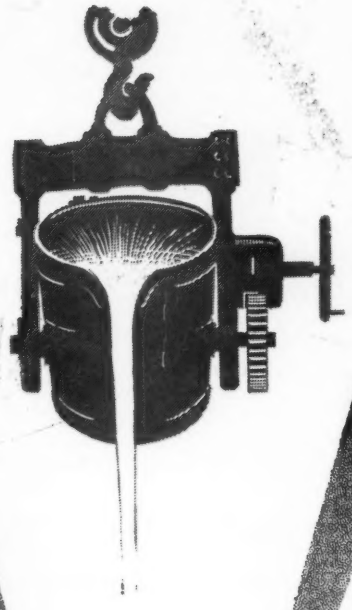

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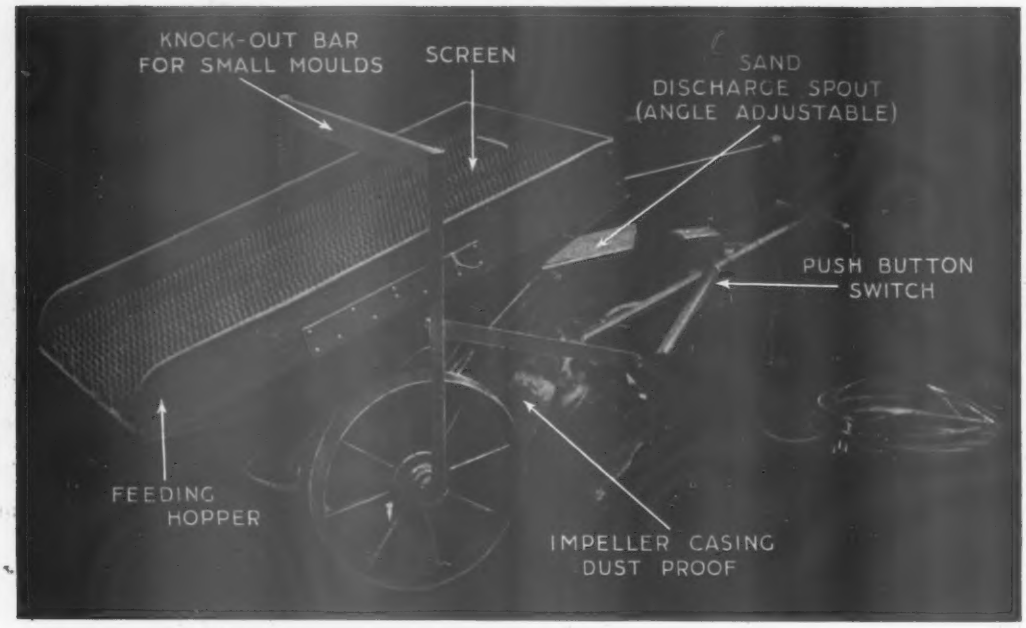

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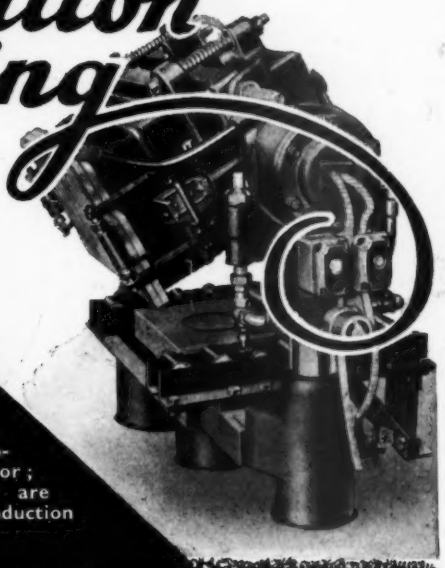

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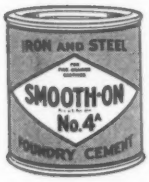

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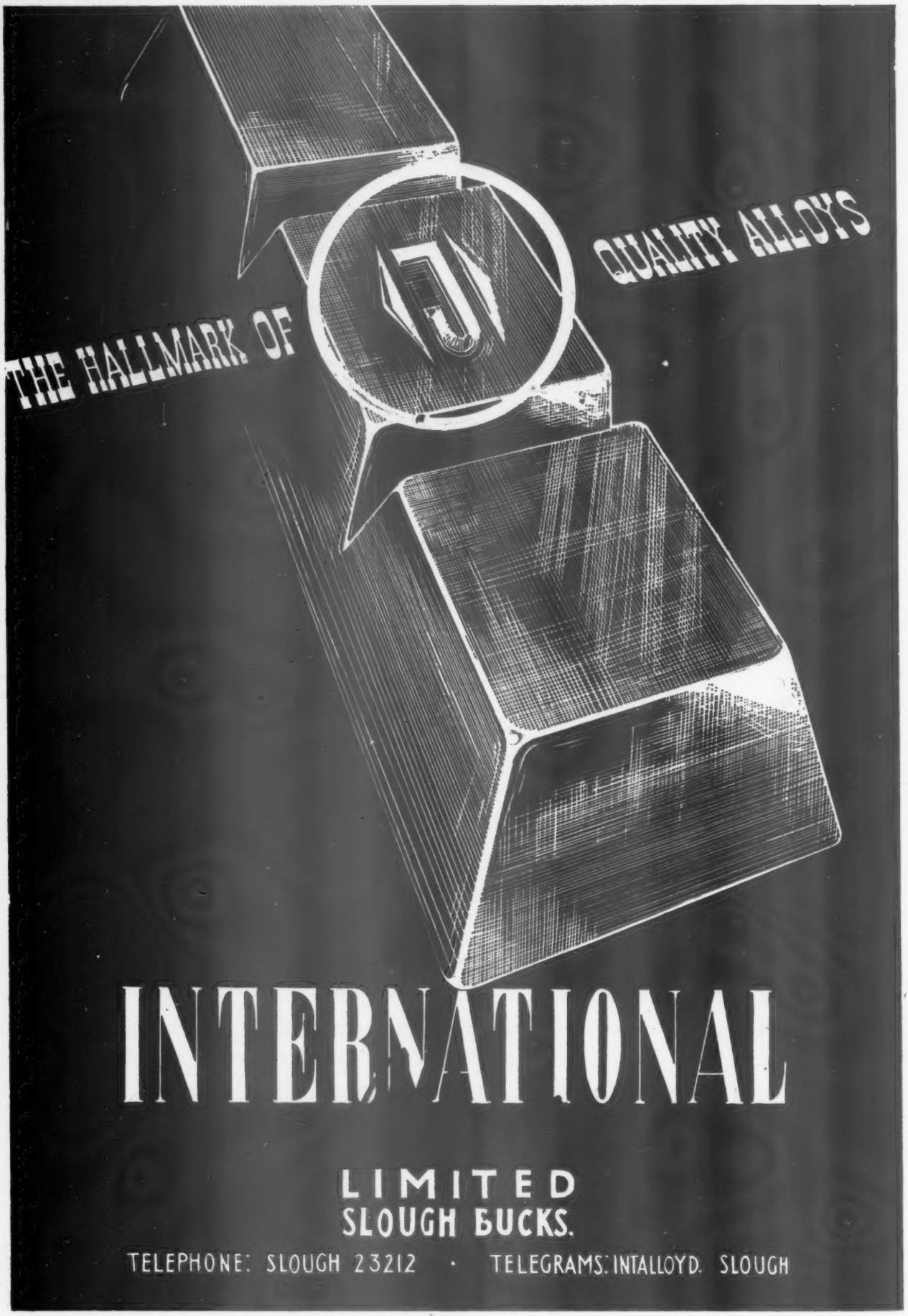
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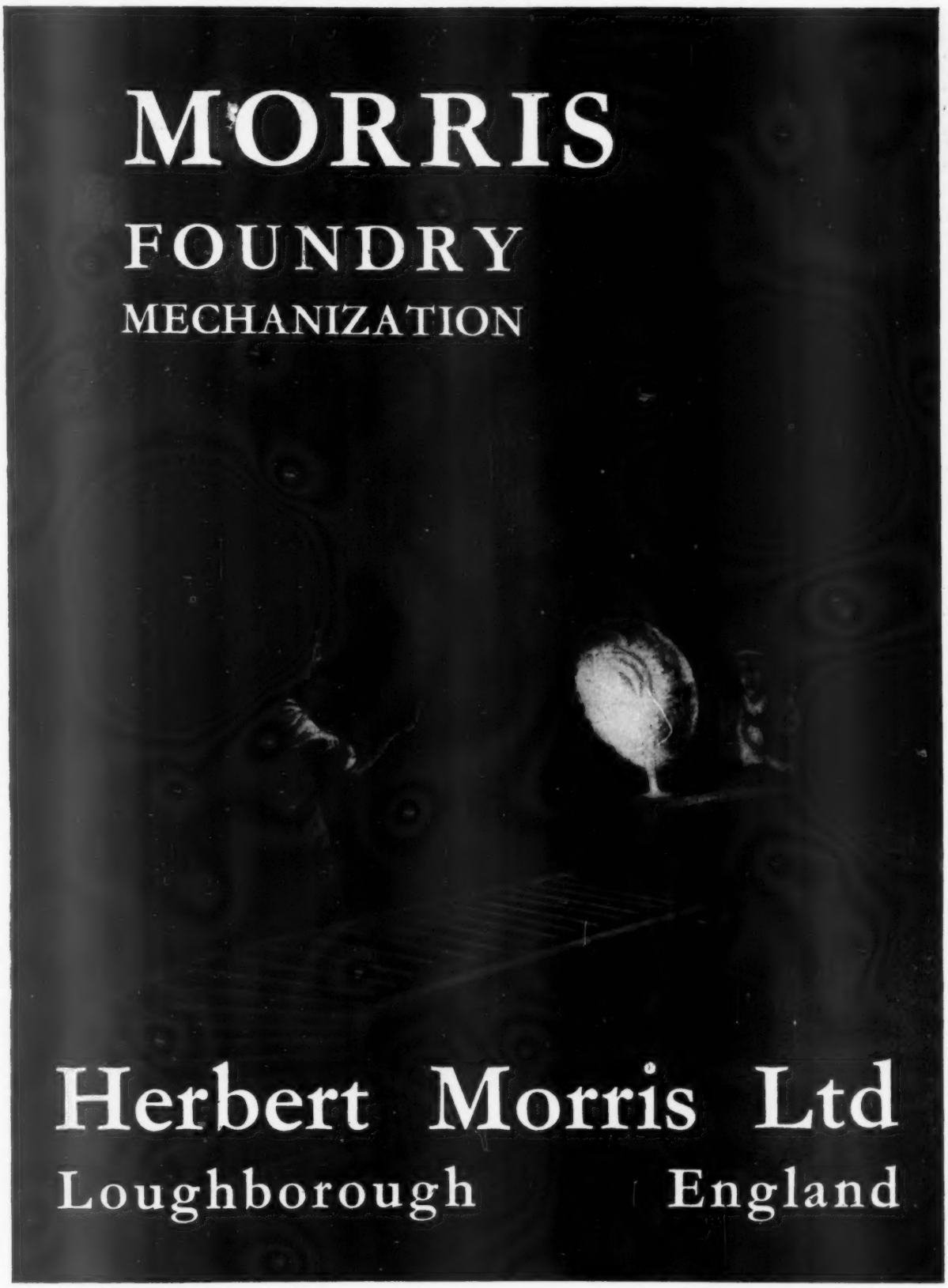
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Important Note

Although the above illustration shows our **No. 24A** type machine, it should be noted that **all** sizes of our "Coleman" Davenport type Moulding Machines can be supplied in design similar to the No. 24A depicted above.

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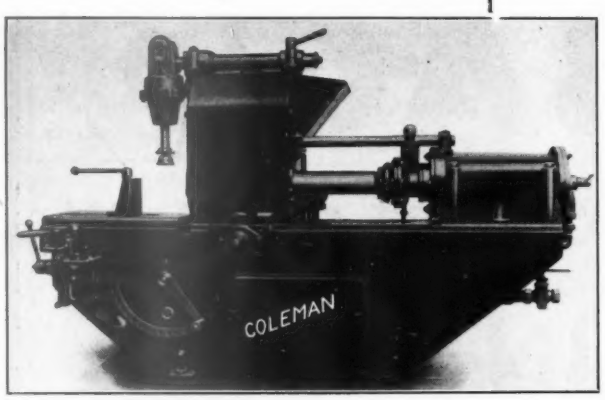
This illustration depicts the "Coleman" Core Machine, type R.2, but we supply these machines in four sizes suitable to cover all requirements. Our Core Machines are the only horizontal Core Blowers on the market and therefore the only successful machines for quick production and perfect cores, and will produce upright, flat and hanging cores. Unlike other machines our Core Machines will utilise both wooden and metal core boxes and **any** kind of sand. The sand in the hopper of our machines is always visible and therefore saves the operator a great deal of time, and the sand can also be replaced without stopping the machine. Also, the core boxes on our machines are not sand blasted, as the core boxes never come under any pressure.



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JAR RAM SQUEEZE PATTERN DRAW MOULDING MACHINE TYPE CN

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14in. Squeeze Cylinder.
6in. Jarring Cylinder.
7in. Straight Pattern Draw.

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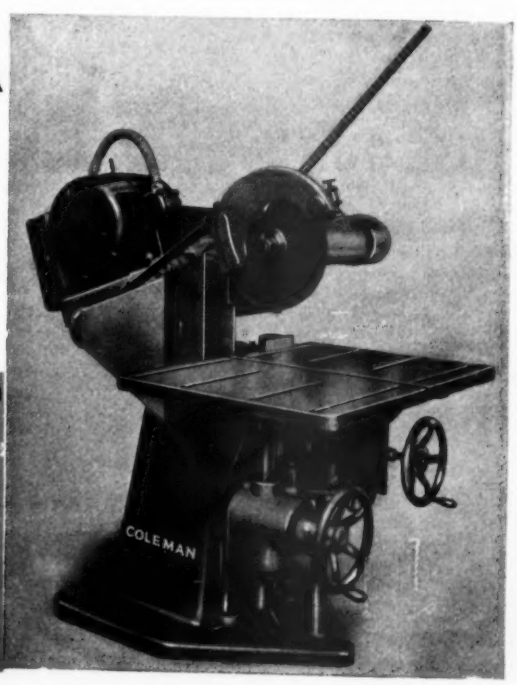
This illustration shows the type CA. Cutoff Machine, but we supply a complete range of these machines to cover all possible requirements. No firm can afford to ignore these machines as they can be used by Foundries, Engineering Works, Refractories and manufacturers or users of "tough" metals and alloys such as manganese steel, monel, manganese bronze, nickel alloys, plastic, stone, glass, nickel, phosphor bronze, gun-metal, iron alloys, steel alloys, carboloy, tungsten, tubes, bars and shaped stocks, tile, plain or glazed, vitrified ware, sand or lime, fire brick, etc. Our Cutoff Machine cuts so clean and close to the body of the casting, that it always reduces and often entirely eliminates any snagging and finish grinding. The machines are so designed and built that they have the rigidity which is essential to a true-running abrasive cutting wheel.
The wheel guard is readily adjustable within safety limits to suit work—it is clamped in position but can easily be swung up out of the way to replace wheels.



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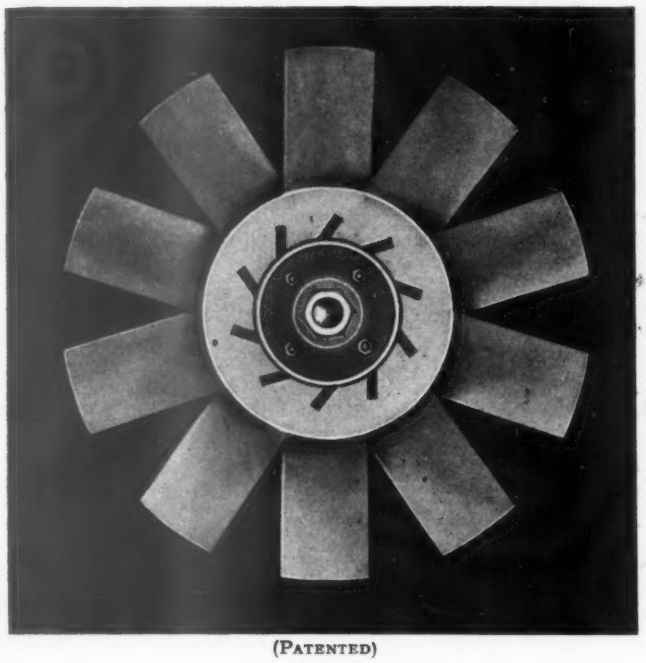

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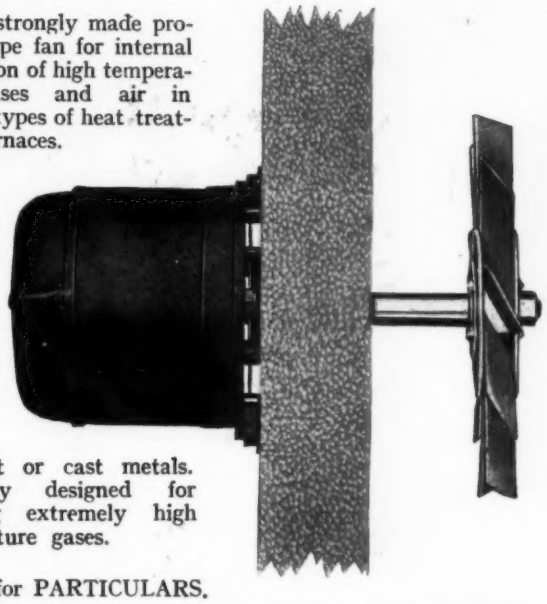

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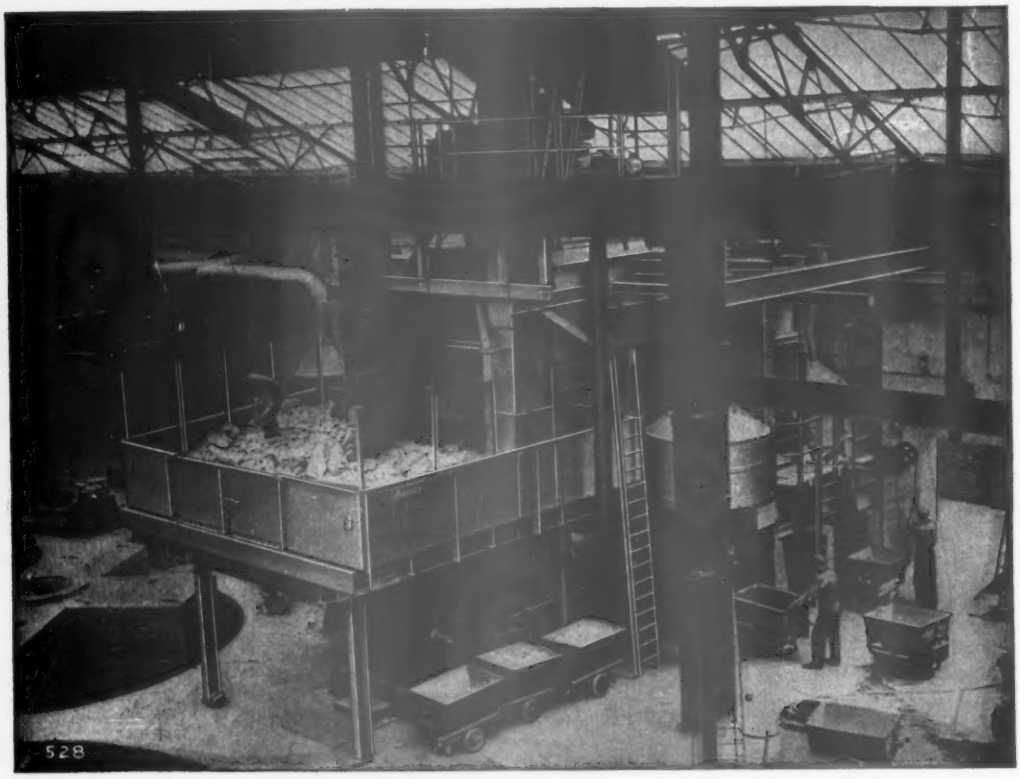

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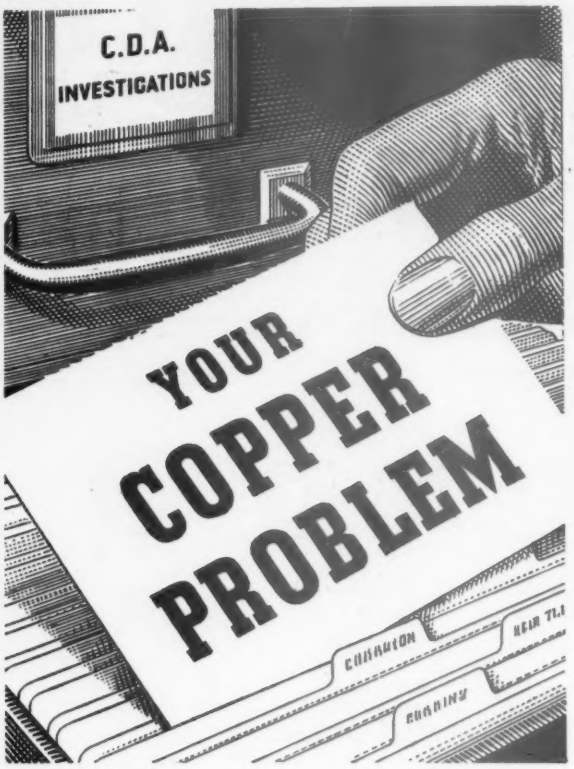

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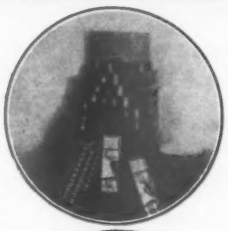

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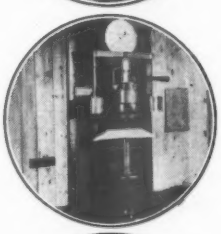

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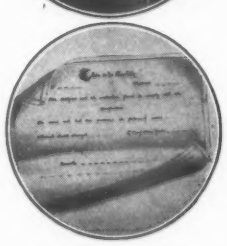

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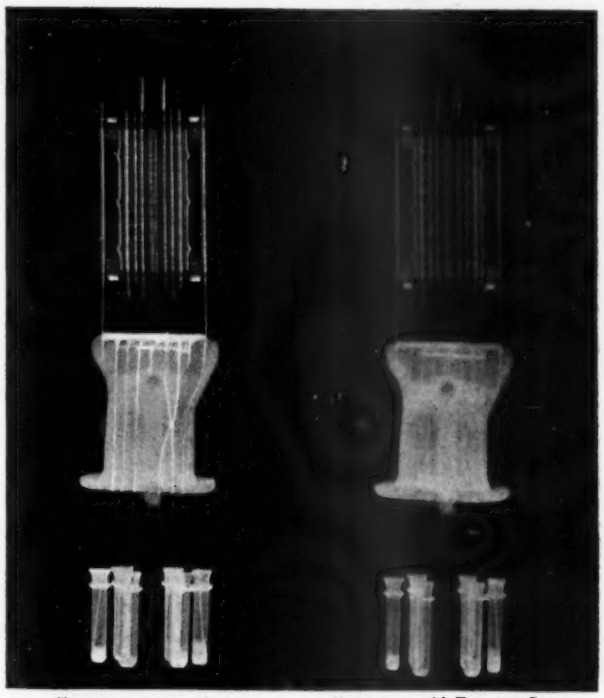

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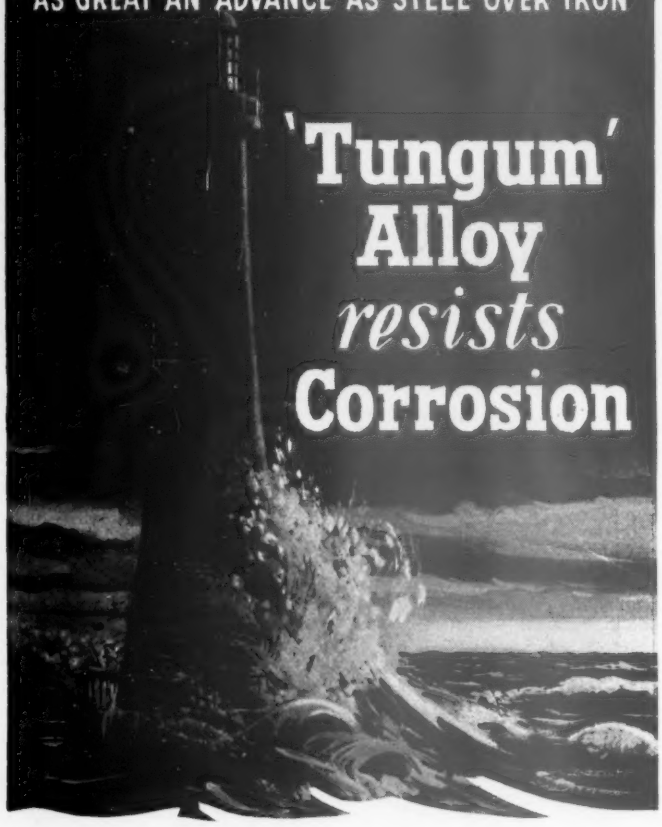

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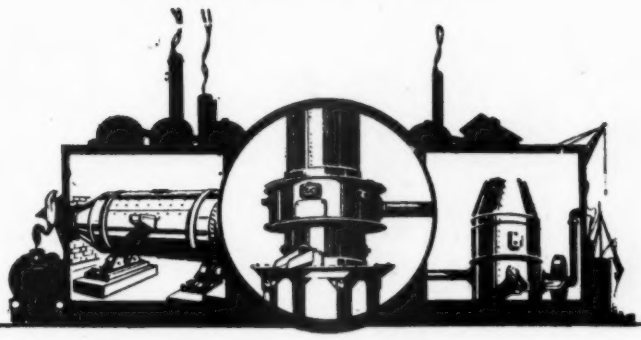

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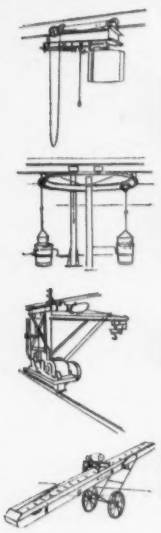

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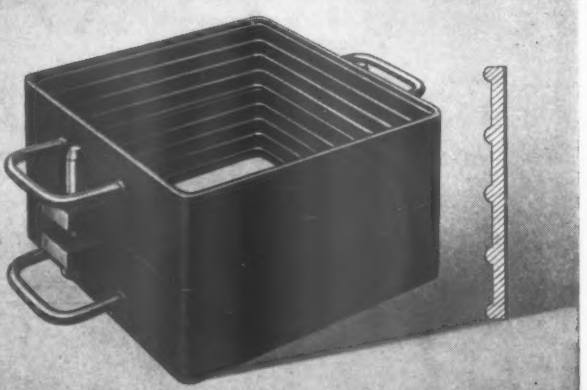

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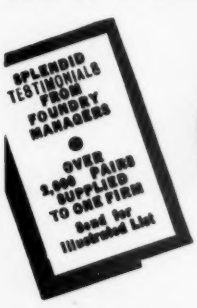

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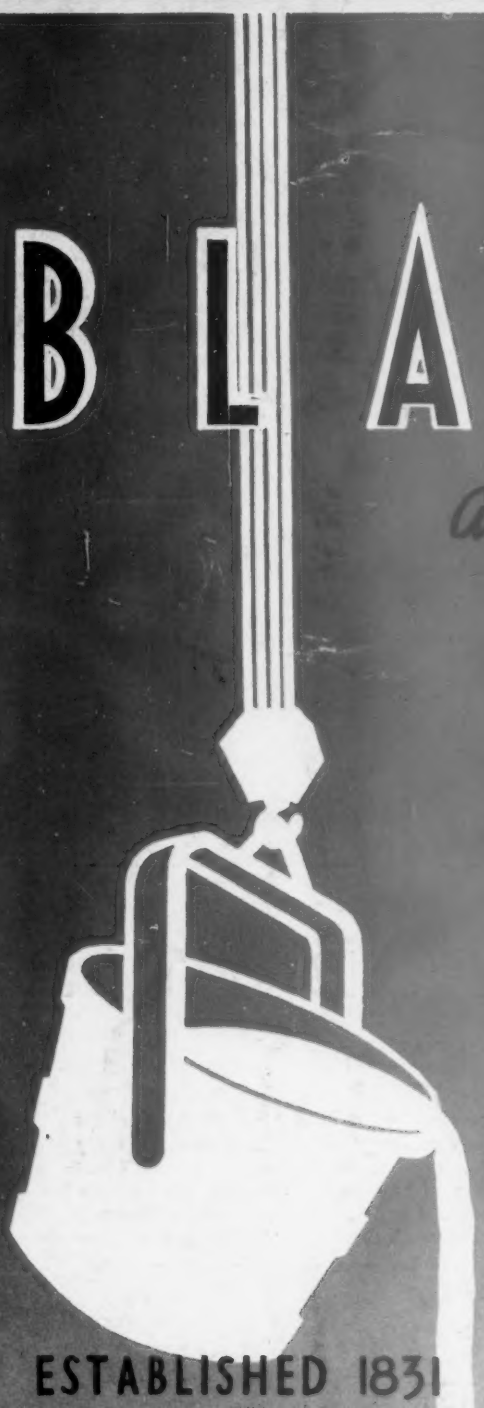

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